THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 40. Thursday, April 18, 1929. No. 661.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (4 lines).

Contents.

	PAGE
Forthcoming Events	281
Trading with Russia—I	281
The Shear Test Again	281
Correspondence	282
Institute of British Foundrymen	282
Random Shots	282
Some Interesting Moulding Jobs	283
The Venting of Dry-Sand Moulds	285
The Training of a Foundry Apprentice	286
Pointers for the Successful Production of Oil Sand Cores	287
New Companies	288
The Production of Foundry Coke	289
Gas Cylinders	291
"John Surtees Memorial" Competition	291
Annealing of Cast Iron	292
Inflated Copper Values	294
Book Review	294
Trade Talk	296
Personal	296
Contracts Open	296
Obituary	296
Reports and Dividends	296
Iron and Steel Markets	298
Institute of British Foundrymen	298
Patent Specifications Accepted	298

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1928-29:
S. H. Russell, Bath Lane, Leicester.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.

Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.

Sheffield: T. R. Walker, 26, Castlewood Road, Fulwood, Sheffield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

Lancashire: H. Stead, 1st/36, Cheetham Hill Road, Stalybridge, Cheshire.

London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.

Newcastle-on-Tyne: P. Sanderson, 15, Handyside Arcade, Newcastle-on-Tyne.

East Midlands: H. Bunting, 82, Otter Street, Derby.

West Riding of Yorkshire Branch: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.

Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.

Middlesbrough: N. D. Ridsdale, 3, Wilson Street, Middlesbrough.

Foundry Trades Equipment and Supplies Association.

President: H. Winterton, Kelvinvale Mills, Maryhill, Glasgow.

Secretary: K. W. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION.

The Registered Office and Laboratories of the B.C.I.R.A. are at:—
24, ST. PAUL'S SQUARE, BIRMINGHAM.
Telephone: Central 1885. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk *(Telephone 332)*

Forthcoming Events.

APRIL 24.

Institution of Production Engineers:—Ordinary meeting at 83, Pall Mall, London. "Factory Rationalisation; or, the Production Director and Business Rejuvenation," Paper by F. E. Taylor.

MAY 2-3.

Iron and Steel Institute:—Annual meeting and dinner.

JUNE 5-15.

International Foundry Trades Exhibition, Royal Agricultural Hall, London.

Institute of British Foundrymen.

APRIL 19.

Sheffield Branch:—Annual business meeting. Paper to be read: "Recent Developments in Cupola Control."

APRIL 25.

Birmingham Branch:—Annual branch meeting, to be followed by a discussion.

APRIL 26.

London Branch (Junior Section):—Annual general meeting in London.

APRIL 27.

Newcastle and District Branch:—Annual general meeting, followed by a discussion on "Foundry Problems," opened by J. Shaw.

West Riding of Yorkshire Branch:—Annual general meeting at Bradford.

Trading with Russia.—I.

From an interview with Mr. Barrington Hooper, the managing director of THE FOUNDRY TRADE JOURNAL, on his return from Russia, we find that the position in that country presents features of great interest for both the foundry industry and those firms supplying its plant. On this occasion we propose dealing with the general conditions as they affect the foundry industry, leaving the special case of equipment industry until later.

Primarily, we are informed that the Soviet Government is particularly jealous of its commercial reputation, and undoubtedly has the intention of paying for any commitments it undertakes. Another factor is that there is only one trading authority—that is the Government itself—and all negotiations are carried out through the President of what is known as the Machinery Syndicate. The Russian Government have decided upon what they describe as the "five years scheme"—that is to say, they have formed a programme for the development of their basic industries during this period, and that they hope on its completion not only to have re-established their plants for adequately meeting their home demand, but also to develop, in certain lines, an export business.

Being devoid of capital, payment for machinery bought must be spread over a period of years. At the moment pourparlers are on foot, based on a F.O.B. payment of 20 per cent., the balance being paid by equal instalments spread over three years, by means of interest-bearing bills. The President of the Machinery Syndicate suggested that his Government was prepared to transact business (providing a satisfactory arrangement could be concluded between the two nations) under three headings:—(1) They would place orders for plant in accordance with their requirements; (2) that they would like estimated quotations for the equipment of certain existing works and the formation of new ones, whereby the contracting firm would completely modernise the works, by supplying plant capable of a predetermined output, for a stated figure, which again would be paid for in the manner outlined above, and (3) that the Government would be prepared to grant a concession to a firm or group of firms to operate an industry or a section of an industry, such as a group of builders' castings foundries, the concessionnaire supplying all the necessary plant and equipment, and marketing the products in the usual way at an agreed figure. Obviously, the terms of such a concession would have to be carefully considered to ensure security in the widest possible sense of the word. The important question of British patent rights is stated to be more than adequately safeguarded. Much detailed information is in our hands, and we shall be pleased to place this at the disposal of foundry owners or their federations interested in this potentially-important phase of industrial activity.

The Shear Test Again.

The Paper published in a recent issue by Mr. W. Jolley, dealing with the shear test for cast iron, is probably the first Paper dealing exclusively with this test prepared in this country. As our readers are aware, the pressure for the employment of the shear test does not come from this country, but from France, and it is only since the French advocacy of the shear test that it has been examined critically over here. We also published an article from Mr. John Shaw also dealing with this question, and as both gentlemen are concerned with the I.B.F. and B.C.I.R.A. Committees dealing with the matter, their pronouncements have a semi-official character, and we understand that the whole of the evidence available, being reviewed by the I.B.F. Test Bar Committee, will confirm the views now published. We would urge all founders, particularly those engaged in producing engineering castings, to read these Papers, for they offer reasoned evidence of the views they advocate, and we believe that those who do so will come to the conclusion that there is no ground for supporting the use of the shear test as against the tensile test.

Mr. Shaw points out that, as a half-way step towards securing an agreement, the French suggested that the question of the shear test might be considered as a matter of principle, but we do not agree that the matter can satisfactorily be considered in this light. From the beginning the argument has been directed towards securing

XUM

acceptance of the Frémont test, in which a small bar less than ¼ in. in diameter is trepanned by means of a hollow drill from a thick section of the casting. This is a highly special form of shear test, and even if the shear test were accepted in principle, as desirable we should be no further towards agreement with regard to the Frémont test. The objections to the latter are based upon the smallness of its size, which would give small errors undue magnitude; poor finish left by the drill in a test which requires the finest possible finish and most careful fitting of the testing device; the actual shear result will depend entirely on the size of the section from which the test piece is taken. A piece taken from the middle of a large boss will obviously be weaker than a piece taken from the centre of a small boss. Finally, this test is done in a single shear, a type of test which is generally distrusted by British engineers and which is never called for in their specifications.

We fear that the average foundryman may feel this matter to be rather remote from his own particular interests, but this country is a great exporter of castings, and once a test finds itself embodied in international specifications it will spread and be used in new applications. It is important that the views of whoever will represent the I.B.F. on the international committee to deal with this matter should be backed up by well-informed opinion in the trade. Otherwise the views expressed do not carry full weight, and are open to the suggestion of being sectional only, or even confined to individuals, just as it is said that the shear test, in spite of the fact that it has been advocated for 20 years or more in France, is not really widely used in that country for controlling castings, and that its advocates form a comparatively small group of people. We are not in a position to say whether this is the case or not, but if so we can only admire the pertinacity with which the French have pressed forward their views in exchange Paper after exchange Paper, not only in this country but in other countries, both America and Europe, with such success that they may be said to have the whole of the European countries other than Germany with them, that is, Belgium, Spain, Italy, and Czecho-Slovakia. The shear-test situation may be a good illustration of the fact that we are generally governed by intelligent and enthusiastic minorities. It would appear that America is not convinced of the value of the test in this form, neither is Germany, although the latter country is flirting with other types of shear test.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

The Brackelsberg Furnace.

To the Editor of The Foundry Trade Journal.

Sir,—Your issue of April 4 (page 257) contains an article by Dr. H. Kalpers, of Berlin, translated from the "Giesserei-Zeitung," entitled "Coal-Dust Rotary Furnace *versus* the Cupola for the Production of High-Quality Malleable Iron."

We take this opportunity of informing you that the construction and development of this patented furnace throughout the British Empire is controlled by the firm of pulverised fuel experts, Messrs. Berg & Company, of Koeln-Kalk, for whom we act as representatives in this country.

They would be very pleased at any time to take the opportunity of showing their demonstration furnace at work in Koeln-Kalk.

Yours, etc.,

Gossell & Son, Limited,

110, Cannon Street, London, E.C.4.

April 11, 1929.

Institute of British Foundrymen.

LANCASHIRE BRANCH.

The annual meeting of the Lancashire Branch of the I.B.F. was held on Saturday, April 6, at the Manchester College of Technology. Mr. E. Longden presided.

The balance-sheet and the auditors' report being passed unanimously, Mr. R. A. Miles, moving a vote of thanks to the retiring officers, said that as a past Branch-President he spoke with some knowledge of the inner workings of the Branch, and he assured the members that this vote of thanks was fully deserved. He extended it to all who had helped to conduct the business of the Branch. In seconding the motion, Mr. Primrose praised the expeditious and business-like way in which things had been done.

The vote of thanks was passed unanimously, and the election of officers for the year was then proceeded with. Mr. E. Longden was re-elected as President, and said the year would be a particularly interesting one to him because the International Foundry Congress, to be held in London in June, would attract visitors from overseas, and he hoped to renew acquaintance with many friends whom he made during his visit to America. His happy association with the Council and the general body of the members during the last twelve months was very encouraging now that he was to have a second term as Branch-President.

The other officers elected were: Senior Vice-President, R. W. Stubbs; Junior Vice-President, E. Flower; Council, Messrs. J. Pell, F. Demaine and C. W. Kent; delegates to General Council, Messrs. W. Jolley, J. Hogg, Masters, R. A. Miles, J. S. G. Primrose, R. W. Stubbs; Auditors, W. Holland and A. Hopwood; Secretary, H. Stead; Assistant Secretary, C. F. Brereton.

The members learned with concern of the persistency of the serious illness of Mr. Oliver Stubbs. In any problem relating to the affairs of the Institute he could always be relied upon to give advice and assistance which his wide knowledge and experience made valuable, and the loss of his services had been severely felt by the Branch Council. He would be especially missed when the visitors from overseas came to Manchester.

The report referred to the works visits which were made during the summer and the joint meeting with the West Riding Branch. Not the least enjoyable part was the way in which the members of the two Branches fraternised after the meeting; because they promoted good-fellowship and comradeship these functions deserved the support of all. The Burnley Section of the Branch had done excellent work in its programme of lectures. So also had the Junior Section under the presidency of Mr. Makemson, who would soon be succeeded by Mr. R. A. Miles. There was no doubt it would continue to flourish under the guidance of Mr. Miles.

Mr. Stead concluded by thanking the Branch-President and the Council for the help they had given him.

The annual dinner of the Institution of Mining and Metallurgy was held on April 10 at the Hotel Cecil, London, Professor S. J. Truscott (President) in the chair. Sir Halford Mackinder, in proposing "The Mineral and Metal Industries," remarked that the vital thing in the future, it seemed to him, was the control of the industries that were concerned with mining and with the working of the materials which were derived from mining. The one great natural monopoly in the world consisted of the deposits of metals and fuels at given points, and those who possessed those points were in control, to some extent at any rate, over the destinies of humanity and certainly of civilisation. They had to develop the great estate of the British Empire or others would step in. Each industry must do its own work to maintain the British civilisation.

Random Shots.

Quite a number of classifications exist into which various people have divided humanity; thus an American writer once grouped people according to those who got up and did a job and those who sat still and said how much better it would have been done the other way. Another one that always intrigues me very much is the distinction between highbrows and lowbrows.

* * *

Can we be divided into two irrevocable classes? Or do the classes overlap? For instance, is there an intermediate class of what might be called mezzo-brows? Then, again, if you are a highbrow, are you a highbrow the whole of the time, or can you occasionally come off your perch and be a lowbrow? I have seen a highbrow defined as a man who has been educated beyond his inherent capacity to take advantage of it. That makes a highbrow a sort of intellectual snob.

* * *

There must, however, be something wrong with this definition, because such a man would be acutely self-conscious, whereas the hall-mark of a highbrow, to my mind, is his complete failure to realise that he belongs to the elect. The same is probably true of the lowbrow, because no true lowbrow would care two straws to which category he belonged, and I am certain that he would never end as a highbrow. Under these conditions neither would be proud of his label.

* * *

These random reflections arise from an observation I have frequently made among certain scientific and other learned friends who are addicted to the reading of detective stories. Few scientific men have any use for literature, and in this respect they resemble what is known in America as the T.B.M. (Tired Business Man).

* * *

When you come to think about it, in light fiction you have very little to choose between the sickly sentimental and the "thriller" or mystery yarn, or adventure or detective story, and male taste certainly inclines to the latter group. One of the quickest cuts to fame and fortune at the present time is to write a really good detective story.

* * *

Being a lowbrow, I have specialised in this type of yarn, and if anybody wants any advice they can have it. Occasionally I make an excursion into highbrowism and read a book that is really worth reading, as distinct from one which merely kills time spent in trains.

* * *

I am, therefore, familiar with the evolution of the detective story, from Edgar Allan Poe, through Conan Doyle to Austin Freeman, and I can discuss the merits of Van Dine, or Connington or Wills Crofts. I am thoroughly at home with the differences between the professionals of Scotland Yard and the amateur sleuths which they find in all grades of society. I can discuss in detail whether an author has been quite fair in giving you all the facts as he goes along or whether he has been keeping something up his sleeve that puts a new complexion on the matter at the finish.

* * *

For my entertainment these gentlemen may plan and commit murder *ad lib.*, because when life is involved the ingenuity of the crook and of the detective is sharpened to its highest point.

* * *

A comedian was snatching a hasty meal in a London restaurant, and, after eating half the dish set before him, called for the bill. "Bill, yessir," said the waiter. "Let me see, sir, what have you had?" "Three fish," said the comedian. "Three, three . . ." repeated the waiter, "but I only brought you two, sir." "No, three," said the comedian firmly, "you brought me two filleted sole and one smelt."

Marksman.

Some Interesting Moulding Jobs.*

By E. Longden.

If it were possible for the high-class jobbing moulder to translate his knowledge and experience into either written or spoken words, there would be rendered available an endless and a most interesting fund of material for the proceedings of the Institute and the industry which

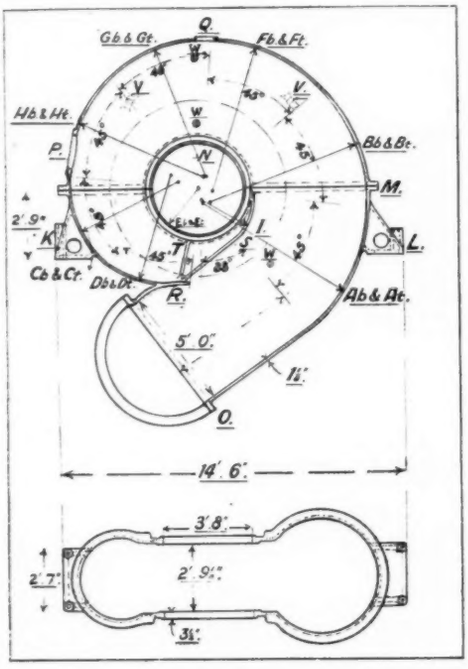


Fig. 1.

it serves. Due to the reticence and inability of most moulders to record their experience in any way and the great difficulty of adequately describing moulding operations, the Institute meetings suffer from a preponderance of technical, scientific and theoretical work. Much of this work is of the highest value, and the Institute is indebted to such authors, but it really lacks work of a practical nature which can be placed before the members.

Those who have close contact with the foundry must realise the extraordinary amount of mental and physical energy required of the competent moulder when making large and intricate castings. It is to his great credit that failures in heavy work are on the average below 2 per cent. A more frequent exposition of the art of moulding would also aid the technical and scientific foundry worker to a better understanding of the value of the practical moulder's work, as perhaps the relative importance of the moulder and coremaker has sometimes been lost sight of. Ninety per cent. of the efficiency of any foundry is dependent upon the trained moulder and the machinery and tools placed at his disposal. Let this type of labour fail, and there is an end to one's competency as a founder, whether it be in ferrous or non-ferrous castings.

The Papers and lectures delivered to branch, and particularly annual, meetings of the Institute are 80 per cent. scientific and theoretical and 20 per cent. practical foundry work. This percentage should be reversed. But, unfortunately, the training of the moulder and foreman will only occasionally allow us to learn of the moulding of castings. This state is not the fault of the scientific and technical lecturers, but the unfortunate effect of the call of the trade upon the mental and physical energy of the moulder. There can be no more exacting form of mental strain in any calling than that existing in the minds of the moulder, foundry foreman or manager when a large mould is being filled with metal.

A Large Centrifugal Pump Body.

Unfortunately, the author has been unable to secure a photograph of the finished casting, or of any stage in its manufacture, and in describing moulding operations one is immediately in difficulties. Photographs of moulding operations can never convey to the reader sufficient detail of construction, but by a series of sketches one is able to lend, as it were, an X-ray eye to the person in search of the real details of a mould construction. The following description should present as much information to the non-practical man, who may be more versed in the study of drawings and details as to the practical man who cannot always follow out his work when placed

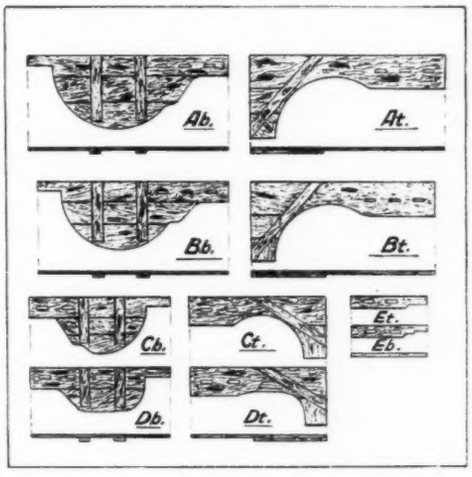


Fig. 2.

before him through the medium of a drawing. Fig. 1 shows sufficient drawing details to allow a reasoned statement of the requirements for pattern-making and moulding. A pump of the size outlined will deliver 400 tons of water per min. expelled through the 60-in. outlet from which the size of the pump is taken. The casting weighs a little under 7 tons. The general drawing dimensions determined by the pump engineer and draughtsman are, for obvious reasons, omitted. The bearings N in Fig. 1 and the dotted circle indicate the relative size of the impeller, which is about 78 in. dia.

Since the usual order is for one-off only, it is prohibitive expense to construct a full pattern and core-boxes. The pattern-maker must, therefore, resort to the provision of sweep or strickle boards and those portions of pattern to shape sections of the casting which it is unable to produce by strickles. The drawing shows that the pump body is made in two pieces, a top and a bottom, whilst the pattern work is described for both halves the practice for loam moulding, the bottom part only will be outlined. The top is produced in a similar manner, much of the tackle made for the bottom half being later used for the top half.

The series of strickle boards, sketched in Figs. 2 and 3, depict by Ab and At and Hb and Ht the various sizes of strickles required. If the drawing is studied the code letters will show from which point each strickle board is used. For instance, Ab and At are used to describe an arc of 45 deg. when working from the centre shown. With the exception of the strickles to form the bearing N and marked Eb and Et, and the straight section from Ab, At to the 60-in. outlet flange, the strickles are used to describe an arc of 45 deg. It is possible to economise in timber by cutting down the large strickle boards to serve for the smaller sizes to the extent of perhaps 25 per cent. It is obvious that Ab, At, Cb and Ct, used for striking up the bottom casting, must be retained to strike up a portion of the mould for the top casting.

Fig. 4 describes the necessary loose pieces of pattern and core-boxes used in conjunction with the strickles. The code letters again indicate for which purpose or portion of the casting they are made. K and L form the feet of the casting, and are constructed so as to allow the core to be made from inside the pattern work. The small core-boxes X, Y and Z are additional core-boxes required to complete the coring of the feet; M is the large flange, which is used to attach the two halves of the casting together; N forms the heavy bearing; O the 60-in. flange; P and Q, handholes; R the plough-like section which, along with sections S and T, form deflectors or baffles for the water being expelled; U is a small core-box, out of which 1⅛-in. by 3-in. thicknessing cores are made; V, lifting lugs; and W, bosses. Having traced out the pattern requirements, one can now describe the work of moulding the casting.

Moulding the Bottom Part.

Before commencing to mould the job, much thought must be given to the requirements to

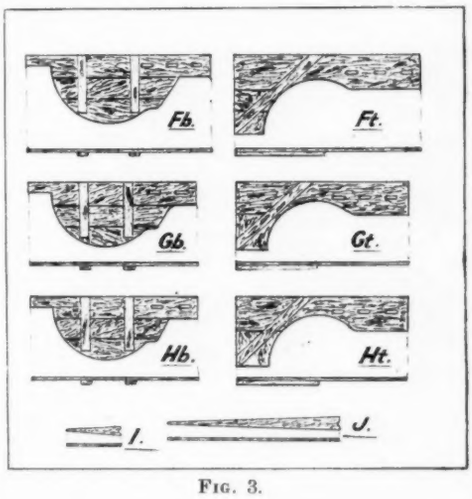


Fig. 3.

produce the casting. The wise moulder endeavours to visualise his work from beginning to end. With such a casting it pays for the moulder in charge of the job and the patternmaker to consult for quite a day before actually beginning to lay out the tackle for moulding. Since the designer has decreed that the pump body must be made in two pieces, instead of, as one might hope, in four pieces, the moulder must proceed to produce his casting. The principal risks and difficulties lie in the thickness of 1⅛ in. in relationship to the shape.

Obviously, the casting is comparatively thin for the great area, and it would be impossible to construct a core which would collapse sufficiently to allow a shrinkage of nearly 2 in. on the casting without special preparation and precaution. The core must necessarily be strong to allow of handling, and so constructed to enable a quick freeing of the casting after pouring.

A strong bottom-plate, as outlined in Fig. 5, is made. A layer of bricks is set in black loam

* A Paper read before the Scottish and other Branches of the Institute of British Foundrymen. The author is foundry manager to Messrs. Hetherington & Sons, Mr. J. Longden presiding.

over the whole face of the bottom plate. Then the jig plate, A, containing nine centres, as described on the drawing, Fig. 1, is firmly located into the position shown. It is then good practice to chalk out on this first layer of bricks the outline of the casting and core prints, position of bearers leading up from the bottom plate and used for supporting the heavy core, runner and riser positions, and even the position the metal ladle will occupy during pouring, should be described in the outline. It is within the author's knowledge, and no doubt others have experienced the same trouble, that there has been on occasion great difficulty in emptying the contents of the ladle during the pouring of the casting. So much depends on the gating and pouring of castings that one is sometimes amazed at the scant attention paid to the pouring basin through which the whole of the metal must pass. Ninety-nine per cent. of otherwise competent moulders will often fail in this last important touch to the assembled mould.

The proper planning out of steps ahead enables the moulder to proceed with a greater assurance

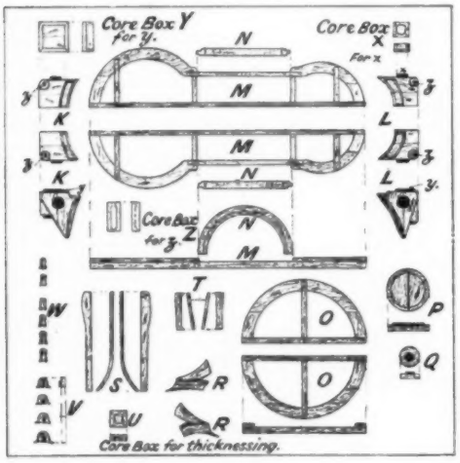


Fig. 4.

that none of those costly hitches, so easily created, will occur. The strickles Ab and Hb are now used to strike up the contour of the bottom face of the mould up to the joint, and which forms a centre line at right-angles to the large flanges. Little information of the bricking need be mentioned, which is quite ordinary except that six horizontal in-gates are arranged to flow into the mould at the lower face-level, as shown in outline in Fig. 5 and in the sectional elevation at G2, Fig. 10. The in-gates are better formed in cores. The in-gates are fed by six vertical down-gates leading up to the joint face and which are in turn fed by the two main down-gates from the pouring basin. Loose pieces of pattern for forming the feet, flanges, bosses, etc., are located by using various gauge sticks similar to I and J, Fig. 3, and straight-edges and set-squares.

It is necessary to mention that, in spite of the large number and shapes of the strickle boards, the moulder must be provided with a number of small loose strickles to blend one section of struck-up mould with another, because, if the casting is studied, it will be noted that, whilst a perfect sweep can be arranged on the centre corresponding with the joint line, the contour of the casting calls for an increase in depth as well as width. At the point where one strickle finishes and the next commences there is an average difference of something like $\frac{3}{4}$ in. in depth. That is to say, a step is formed on the bottom face of the mould and which disappears as it rises to the joint-line, where the correct shape formed by the sweeps is encountered. It is across these areas that the moulder is called upon to use loose wooden strickles and tools to blend or graduate the mould according to design.

Having struck up the mould to the joint-face, the mould is well-finished and blackened, the loose pieces not being removed at this juncture. At this stage the mould is lifted on the stove carriage and given about 12 hours' drying, taking care not to produce too high a temperature and that all loose-pattern wooden work is well covered with wet loam to prevent too much shrinkage and perhaps burning of the material.

From this stage until completely built up the

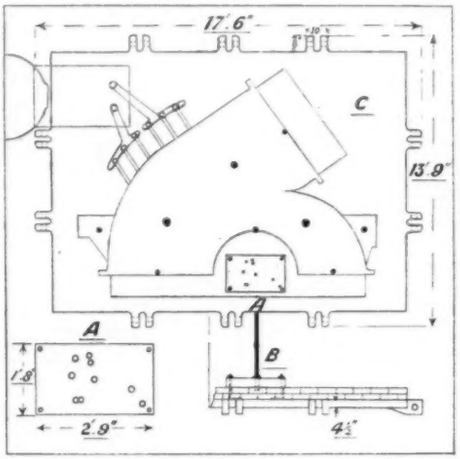


Fig. 5.

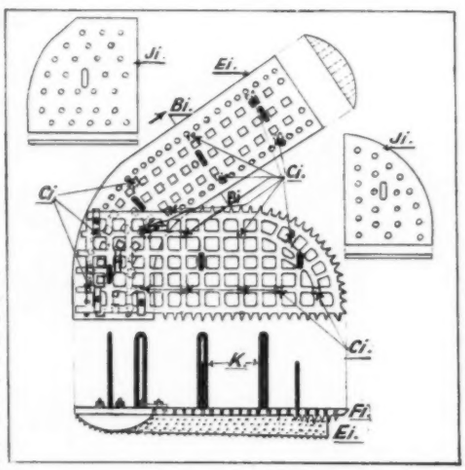


Fig. 6.

mould is not removed from the stove carriage, on which all further work of building is carried out, the reason for this being to take advantage of each night to carry on the drying of the mould as it grows, because the weight of the building will soon be beyond the lifting capacity of the cranes. The completed mould will exceed 100 tons.

Core-Making Details.

The construction of the core is the next step. The mould is withdrawn from the stove and the whole of the surface covered with a 1½-in. layer of hard-rammed loam sand. This is done by making a large number of 3-in. by 1½-in. square slabs of core from the core-box U, shown in Fig. 4. The surface of the applied thickness is well-finished and blackened, and again stoved for a few hours. As previously mentioned, the core is specially constructed to allow the casting freely to contract on cooling.

Figs. 6 and 7 show the necessary cast-iron grids or lifters. E1, Fig. 6, is shaped to conform to the contour of the bottom face of the core. This iron is lightened a little by coring out with loam bricks and cores, and the underside, which must come in contact with the loam, is jagged and serrated so that the material will adhere. The accompanying main core grid, F1, is soundly bolted to the main grid, E1. Grid F1, it will be noted, is made to carry the flatter surface of the bottom face of the mould. The lifting staples, K, must be made of sound material and well sunk in the cast metal.

Plates J1 are made to cover the area of the grid F1 beyond that of the main under-grid. On looking later at Fig. 10, the reason for this will be apparent. The plates, J1, are bedded on loam, spread over the surface of F1 to prevent the pressure of metal bursting through the underside into the interior of the core.

The building of the core is proceeded with by carefully laying over the thickened mould good loam to a depth of about 1½ in. The two main core-grids are washed with thick clay-water, and are then bedded down in the loam. The surface under the grid F1 needs additional support, which is obtained by the use of a few short gaggers. After bedding the plates J1 in loam

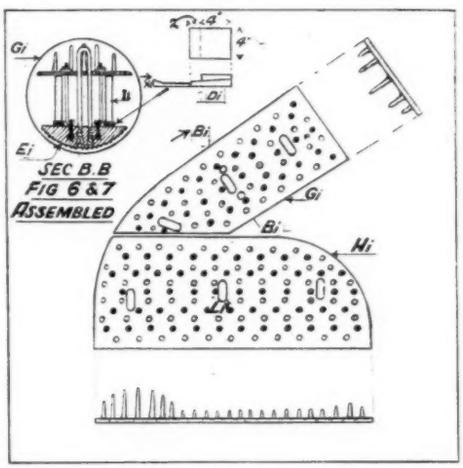


Fig. 7.

above the grid F1, to which they are bolted, a 9-in. brick wall with a loam face to the casting is built sufficiently high to allow the strengthening plates G1 and H1, Fig. 7, to be placed into position. But before placing these top plates into position cast-iron columns, marked I1, shown in Fig. 6, are located resting squarely on iron wedges, D1, arranged at intervals, as indicated by the points C1, Fig. 6. Pieces of cast-iron plate are shown at D1, placed in front of the wedges so that when the time arrives to free the core, wedges can be quickly knocked forward without mishap and loss of precious time, when it is necessary to relieve the casting for contraction.

The inside of the core is loosely filled with broken brick and cinders to reduce the air. This is done to prevent the danger of an explosion, which might occur if a drop of metal finds its way through the brickwork at the moment when an explosive mixture of gas is present. The plates H1 and G1, containing prodders uppermost, are seated down on the 9-in. brick wall and the cast-iron supporting columns. The space between the prodders is next built in with brick work and loam, and the strickles At to Ht brought finally into action to form the top surface of the core. Here again the moulder uses additional short strickles and tools to blend the points of contact of one strickle with another. After finishing and blackening the top half of the core the whole of the mould is again dried. Thicknessing cores are next laid over the surface of the core to form the 1½-in. metal thickness and the upper and outer face of the mould.

(To be continued.)

The Venting of Dry-Sand Moulds.*

By E. Flower.

The Venting Operation.

The majority of moulders are of the opinion that a vent is never wasted; but the author has arrived at the conclusion that it is frequently a waste of time, and has accordingly elected to give the general subject further consideration. In order to demonstrate the extent of this wastage, the first stages in the moulding of a large bed, say 20 ft. long, may be given as an example.

For the type of work shown in Fig. 1 a hole is dug in the floor about 2 ft. deeper than is actually required to accommodate the pattern. In this is placed a sufficient layer of ashes, which is covered with straw, or similar material, and rammed tight with floor sand. Strips are then laid to suitable camber, and the whole is rammed again with floor sand to within two or three inches of the top of the strips. The whole surface is vented with a $\frac{1}{4}$-in. or $\frac{3}{8}$-in. vent wire down to the cinder bed, the tops of these vents being stopped up, the whole area rammed with facing sand and strickled off level with the top of the strips. The whole area—or that part upon which the metal has ultimately to rest—is then gone over minutely with a needle wire, connecting down to the large vents underneath the facing sand; and finally these vents are rubbed or corked over. The bed is then ready to receive the pattern.

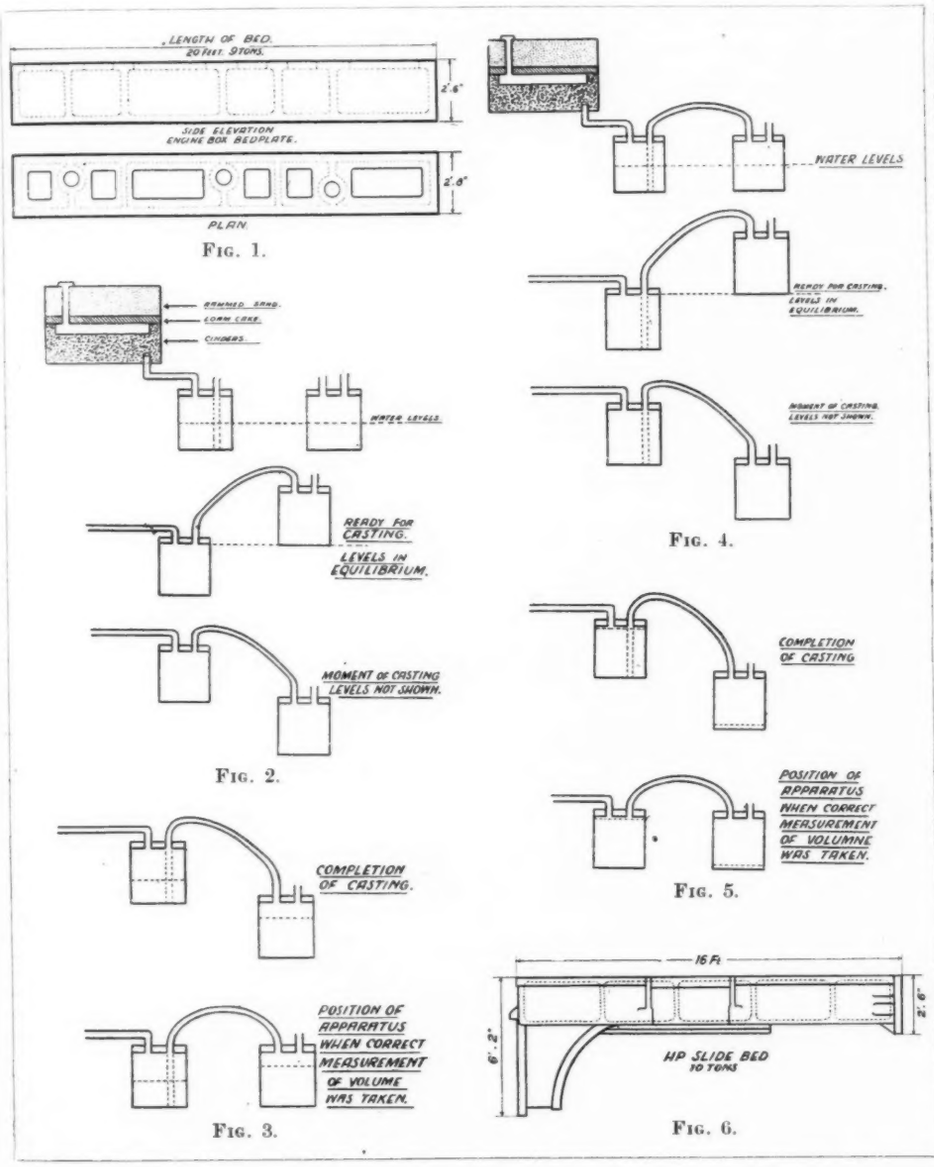


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

Anyone who is conversant with this class of work knows how long it takes to get as far as this; and the author wishes to prove that not only is this time wasted, but the whole of the work is a danger instead of a help to the production of a good and sound casting.

Formation of a Sump.

Assuming that the ramming and finishing has been completed, and that the job has just been fired with the top parts closed over, if one can visualise the action that is taking place on the bottom surface of the mould, instead of the moisture being drawn up with the heat of the fires, owing to the inside area of the mould being quickly filled with humidity drawn directly from the sides, the moisture from the bottom face is being forced down into the bed of cinders through the carefully-prepared vents. On reaching the cinder-bed the moisture, in the form of steam, is immediately condensed to water, and here it lies dormant in a kind of "sump."

After sufficient time has elapsed for the mould to dry perfectly, the whole job is stripped and cleaned out ready for coring and preparing for casting, which time might take anything from one, two or three days. Visualising the action that is taking place on the bottom face of the mould, until such time as the job is ready for casting, the bottom face of the mould, which was perfectly dry before withdrawing the fires, is like a sponge as far as porosity is concerned. Owing to such a long time elapsing between drying and casting, moisture is sometimes drawn up from the "sump" referred to previously. In some instances, when the metal reaches such surfaces, the mould shivers, and the metal leaps up, causing disastrous results. In other instances, scabs are caused on the face of the casting, which can sometimes be chipped or machined off, but frequently cause the casting to be scrapped. Sometimes these scabs occur in one place, sometimes in another, and if they are caused by the mould not being perfectly dry in the first instance, why are they local, and not over the whole face of the mould? This is because, in the first instance, the mould was perfectly dry, but owing perhaps to one part of the mould being vented more than another, it allows the dampness to be drawn up from the sump more readily in that particular place. When a dry sand job scabs opposite the runners the cause is often ascribed to the cutting action of the metal, but after sprigging that part of the mould, in the next one made one finds that it has scabbed somewhere else. Numerous other instances could be readily quoted.

Whenever these phenomena occur the general inference is to turn to the man in charge and say that either the job has been insufficiently dried or it has been inadequately vented. The author is of the opinion that the root of the trouble in this class of work is caused through trying to prevent it by the wrong method. It is foolish to insist that it is impossible to make a job successfully under this system, as he had himself made, and had also seen made, dozens of jobs of this description turned out without a scab or blemish of any description, although cast in dry sand with a cinder-bed underneath. But unquestionably the danger was always there, and moreover was there unnecessarily, not losing sight of the fact that it was all a waste of time.

Green-Sand *v.* Dry-Sand.

The credit for the introduction of dry sand moulding on a commercial scale is generally ascribed to the late Mr. John Surtees, who conceived the idea of making marine-engine castings at Messrs. R. Stevenson & Company, of Newcastle, about 1865. Why Surtees carried forward the system of putting cinder-beds under green sand jobs, and made it applicable to dry sand, was unknown, but it seemed that the change-over was done automatically and has been continued to the present day without its necessity being seriously considered.

The question of green-sand or dry-sand moulding then raised the much-discussed problem as to which of the two methods is the more economical in the making of a particular job. Each method has its own particular merits, but probably the predominant feature in regard to green-sand is one of speed or time delivery of a casting. If, however, this contingency can be dismissed, there are countless reasons why one should give preference to dry-sand. According to the history of the introduction of dry-sand moulding to the foundry, it is interesting to find that the reason for the first experiment was the same as that which nowadays determines the superiority of green-sand over dry-sand, namely

D

* A Paper presented to the Lancashire Branch of the Institute of British Foundrymen, Mr. E. Longden presiding.

quickness and cheapness; but in the former case dry-sand was a substitute for loam moulding.

It seems desirable to prove that it is cheaper to make a job of this description in dry-sand; (1) by eliminating much unnecessary labour, and (2) it is a fact that a job made in dry-sand is far sounder than when moulded in green-sand.

It is well known that dry-sand mixtures do not contain the same quantity of combustible materials, not only due to their absence in the green state, but also due to the action of the heat during the drying process. Besides being much stronger than in the green state—which allows the moulder more latitude for the finishing and mending up of broken parts—they are much harder and stronger after being dried, and the porosity is such that it takes care of the gases that are evolved during casting.

Comparison of the Volumes of Gases Evolved.

Fig. 2 represents a model of a type of job similar to Fig. 1, in so far as taking care of the gases evolved is concerned. It is a totally-enclosed iron box, in the bottom of which is placed a layer of cinders, and the whole job duplicated on a small scale. The actual size of the mould is 8 in. by 4 in. by 1 in., with a volume of 32 cub. in. The only two openings in the box represent an inlet for metal and an outlet for gases. Connected to the outlet by means of a tube is a vessel filled with water, connected to which is another vessel filled with air at atmospheric pressure.

In making this test it is seen that as soon as the iron comes in contact with the mould facing, chemical action takes place, owing to the heat of the liquid iron having a burning effect on the sand and evolving a gas which, in itself, is not excessive if taken in conjunction with the area of the mould, and providing that

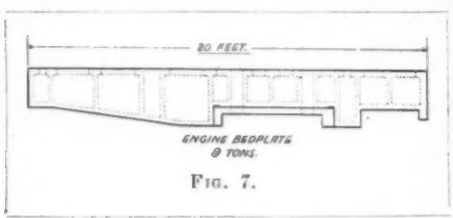


Fig. 7.

the mould is perfectly dry; but the gas evolved is too voluminous to be absorbed in the pores of the sand directly underneath it, because the vents give it a free passage to the cinder "sump" previously referred to. The heat of this gas, coming into contact with the humidity which is surrounding the coke bed, causes a combination to take place which increases it tenfold in volume.

Fig. 3 shows the actual amount of gases which were evolved under this test. The displacement of water was 800 grammes, or 800 c.cs. drawn off from a mould with a volume of only 32 cub. in.

Figs. 4 and 5 represent the casting of the job under the second condition; that is, without a cinder-bed or any other artificial venting. It is shown that the actual displacement of water is 4 grammes, or 4 c.cs., of gases which, without the drawing effect applied to the test, would have been nil, thus showing that the natural venting properties of the sand itself were sufficient to take care of all the gases evolved.

Jobs made in Dry-Sand without Venting.

Can this job be carried out successfully on the foundry floor? Fig. 1 shows a steam-engine bed-plate, 20 ft. long, 2 ft. 8 in. wide by 2 ft. 6 in. deep, weighing 9 tons. It has a metal thickness at the bottom of 3 in. and occupies an area of 7,680 sq. in. The job was made in dry sand without a cinder bed or any other artificial venting, and the casting when dressed was quite clean and free from scab or buckle. It has been found unnecessary to make any allowance for camber, as the castings are turned out true to shape.

Fig. 6 is a H.P. slide-bed 16 ft. long, weighing 10 tons. The bottom is on three distinct planes ranging from 2 ft. 6 in. deep at one end to 6 ft. 2 in. at the other, one of which is a machine-faced working-slide, the importance of which will be appreciated.

Fig. 7 shows an engine pedestal bedplate, 20 ft. long, weighing 9 tons, the bottom faces of which are on four different planes, and which is all metal, with the exception of the two round bolt-hole cores, 6 in. in diameter, which cut right through the casting. Several firms have recently made a type of cylinder of unquestionably intricate design in loam with very varying results. Often they have left much to be desired. At the present time it is being made in dry sand, the results of which up to now have been 100 per cent. good castings. The diameter of this cylinder is 9 ft. by 7 ft. deep, with head; the branches at each side are 7 ft. 10 in. by 4 ft. 10 in. It weighs approximately 10 tons. This casting requires deep consideration, owing to the unequal contraction that is set up by the conglomeration of pockets at each side. Some of these pockets are 9 in. deep, with metal running on three sides; and there is neither a cinder nor artificial vent of any description anywhere near them. These castings are being delivered to the machine shop spotless and free from scabs, and, what is of greater importance, perfectly sound.

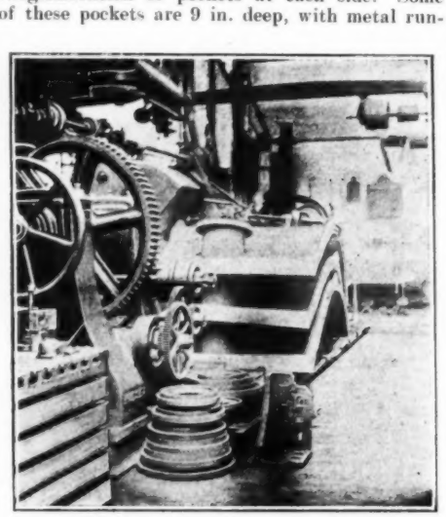


Fig. 8.

Fig. 8 illustrates a peculiarly shaped cover, 10 ft. by 5 ft. 6 in.; it weighs approximately only 25 cwts. owing to it being only $\frac{1}{8}$-in. metal. There is a flanged branch cast on, and in the middle there is a half-round trough running right across the casting. Previous to being made at its present location this casting was made in green sand, but with little success, owing to its buckling and warping, to rectify which an extra $\frac{3}{8}$ in. of machining was allowed on each side for truing up. At the present time this job is being made in dry sand, flange down, and the extra machining allowance has been taken off the pattern. There are no vents in this mould.

The author wishes to thank Messrs. Buckley and Taylor, Oldham, for the facilities given him in carrying out these tests, and particularly to Mr. F. Demaine for his valuable help.

An extraordinary meeting of Messrs. Williams & Williams, Limited, manufacturers of metal windows, is to be held at Reliance Works, Chester, to-morrow, to consider a resolution to increase the capital to £350,000 by creating 100,000 additional £1 ordinary shares.

The Training of a Foundry Apprentice.*

A new view of the problem of foundry apprenticeship was considered at the foundry conference recently held at the University of Wisconsin. In four days a representative group of operating men considered many phases of the problem in round-table discussions, where comment was free and spontaneous.

At the very first an interchange of views was had on how to attract desirable recruits and how to induce more foundries to give some attention to training of young men. Many difficulties were considered. Among them was the problem of giving proper training in foundries doing an extremely limited line of work. It was suggested that this objection might be overcome by co-operation between various shops, each producing a restricted line of work, but together providing a sufficient variety to justify an apprenticeship. Apprentices could circulate through the different co-operating shops in the course of their training.

The aversion of most boys and young men to the dust and dirt in foundries was also considered and declared to be the result of a reputation which the industry has but which is no longer justified. Most foundries are making an honest attempt to improve working conditions, and noteworthy results have been achieved. At the same time a certain amount of dirt appears to be inseparable from foundry operations. Since the number of applicants for apprenticeship in the foundry is restricted, those who do come have less competition for promotion. This should be a special inducement.

An answer to the question, "What may an employer justly expect of the graduate of a four-year foundry apprentice training course?" was formulated. The question may be phrased in other words: if an apprentice graduate applies for work in a foundry, what work may he be assigned to and what work cannot be expected of him? At the end of the session the group had agreed that the following could justly be expected:—(1) General moulding skill on the floor, in green- and dry-sand, and on the bench; (2) general skill in core-making, both bench and floor; (3) an understanding of melting operations, although not skill in them; (4) knowledge of the control and preparation of moulding sand; and (5) a general knowledge of the scientific facts and principles upon which the industry is built.

Minimum requirements of an adequate foundry apprenticeship were also considered. A formal indenture or agreement between the employer and the apprentice is practically necessary for proper control and for success of the programme. Proper shop supervision and instructions (that is, responsibility for the teaching and control of apprentices to be placed upon one or several individuals) were declared to be necessary, as well as suitable arrangements for theoretical or related trade instruction.

Helping moulder, green- and dry-sand moulding, bench moulding, core-making, cupola or furnace operations and casting inspection were called essential in an adequate programme of foundry apprenticeship.

Finally, the group attempted to specify the conditions which must exist in a plant before apprentice-training may be successfully undertaken. Of these the following are the most important:—(1) The conviction and enthusiasm of the management; (2) a careful survey of the facilities for training provided by the shop in question; (3) the laying out of a careful plan of training and machinery for its administration; (4) the conviction and enthusiasm of the foremen, department heads and other supervisory officials; (5) placing responsibility for the work; (6) schedules of work and pay; and (7) suitable school courses and arrangements for teaching them.

---

* Extracted from the "Iron Age."

Pointers for the Successful Production of Oil Sand Cores.*

By W. West.

The foundrymen extensively interested in the use of oil sand could be divided roughly into two classes—firstly, those who are engaged on a standard line of production in which intricately-shaped cores are needed and where precision of dimensional details is of great importance; a typical case would be the manufacture of motor cylinder castings. Secondly, those who appreciate the general benefits of oil sand, in so much that coremaking is immensely simplified and the cost of fettling the finished casting very greatly reduced thereby.

In either of these cases, even where the nature of the work produced has some similarity, it is not uncommon to find a great divergence of opinion in the details of preparation and use. Some prefer to use the virgin sand in its original condition on the one hand, purposely ignoring any fluctuation in the percentage of moisture present, yet, on the other hand, one finds the practice of first drying the sand quite common and in some cases where the addition of water is preferred, to make such, of a predetermined amount and to adhere rigidly to it for the sake of consistency.

Binding Agents and Equipment.

The types of binding agents on the market are still numerous, and their merits and demerits continue to be open for discussion, but this perhaps only holds good in those cases where the price question is one which is keenly felt and the use of a standard vegetable oil beyond the resources of such organisations on the score of price. This condition of affairs opens the door for the many and varied organic by-product compounds which certainly meet a need in this direction.

Mixing machines, drying stoves and methods of drying constitute the complement of those salient factors which from a practical point of view contribute to success or otherwise of oil sand application in the foundry. Whatever attitude is taken, however, in connection with these individual details, and it can be well understood that in many cases a foundryman's attitude is largely moulded by the latitude allowed him by his governing body; there are also outstanding principles, independent of ways and means, in the form of plant which must be adhered to in all cases if the best and most economical results are to be obtained.

For an example of this statement, and therein lies the proof of it, the writer has yet to see the foundry which can bake any oil sand cores correctly and consistently in the same oven as loam or naturally bonded sand moulds or cores are being dried.

The process is fundamentally wrong, inasmuch as the quicker the baking of an oil sand core the better the result, for a quick drying process means that the factor of temperature is raised, which will drive off a greater proportion of volatile matter the higher this point is taken, provided always that the cores are not burnt.

Naturally-bonded sand-moulds and cores call for a prolonged drying process, in which case oil-sand cores are either overbaked to a state of great feebleness or insufficiently processed, which endows upon the core shapes a brick hardness—an admirable condition to evolve a maximum percentage of gas when brought into contact with molten metal. It will be clear, therefore, that the two processes are entirely different in character; on the one hand, it is simply a matter of drying without chemical change taking place; on the other hand, the changes are essentially chemical and are only complete at definite temperatures, when the oil and mixture ingredients are changed into new compounds. It is well, therefore, to commence with the fixed intention of carrying out the process of oil-sand coremaking to the very best advantage. Do not, therefore, be satisfied with any type of binding agent because of its low price, or drying stove left by some predecessor, who perhaps was not insistent enough with his chief to press the point that up-to-date plant is needed in the foundry equally as much as in the machine shop. The chief is invariably an engineer and readily appreciates the needs of that side of his business, but any old thing will do for the foundry; if he is allowed to think so and depend upon it his notions in most cases in this direction may need some correction, and such will be welcomed if progress is the aim of the firm.

Bad mixtures, well mixed, or good mixtures ineffectively mixed as a preliminary to the probability of incorrect baking are additional factors responsible for many more waster castings than most foundrymen are prepared to admit. The reward, however, of well-directed processes can be brought into being by a consistent carrying out of basic principles as are common knowledge to the foundry trade.

Sand Drying and Delivery.

The diversity of opinion which exists upon the question of drying unbonded sand before use is largely based upon individual opinion of the circumstances prevailing in each foundry. These circumstances are surely controlled by the rate at which the castings are manufactured, an intensified production-shop must benefit greatly from the use of dried sand inasmuch as the period of baking in the oven is considerably reduced. The composition of the core mixture, too, has a decided influence upon this question, for, where such components such as molasses, rosin and gums are used, the presence of water in a small degree destroys the green-bond strength of the mixture. The trouble expended in first drying the sand will be found to be worth it and appeals to many, solely on the point that regularity of practice is one of great importance.

It is customary to use large revolving barrels upwards of 29 ft. in length and 5 to 6 ft. in diameter, where quantities of dried sand are required in bulks of 3 tons per hour. These large machines require an appreciable amount of power to drive them, and, too, the usual firebox at one end leaves something to be desired on the score of economic distribution of heat. Because of the cumbersome shape and large amount of space required to accommodate the plant, the home produced appliance shown in Fig. 1 was devised and has proved a unique success. The complete sand dryer consists of a motor, reduction gearing, sand-drying chamber, heat generator, and combined fan and motor. The motor is of 5 h.p. driven by alternating current at a speed of 900 r.p.m., and in turn drives through the reduction gearing the drying chamber at a reduced speed of 3 r.p.m.

The drying chamber is of exclusive design, being cylindrical in shape, 7 ft. long, 30 in. diameter, and positioned to have 5 in. fall over its length. Internally it is equipped with four vanes arranged in spiral fashion along the full length of the chamber; each vane describes 90 deg. of the circumference, and projects inward from the side at an angle of 90 deg. to a tangent of the circle. The function of the vanes is to pick up the wet sand, which is fed into a hopper at one end of the barrel, and also to propel it along towards the further end, where outlets are arranged in the shape of slots for the dried sand.

Heat for drying is transmitted from a unit-heater to the drying-chamber by means of a steel tube which passes from the outlet of the heater and through the drying-chamber, and is received in a socket in the end plate of the chamber.

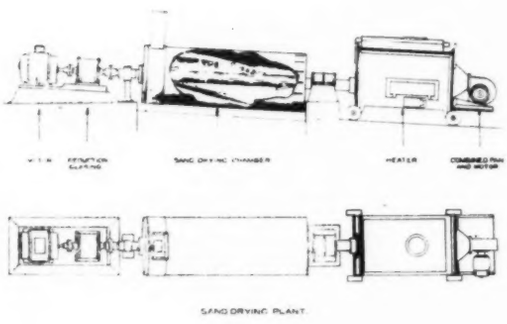


Fig. 1.

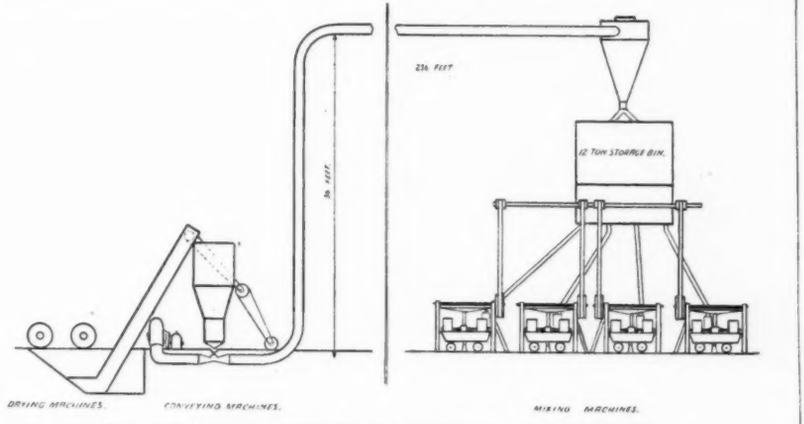


Fig. 3.—Air Pressure Sand Conveying and Mixing Plant.

* A Paper read before the East Midlands Branch of the Institute of British Foundrymen, Mr. J. Lucas presiding.

It thus forms a shaft on which to carry the weight of the barrel in the bearings provided. Heat escapes through a large number of slots in the tube and circulates the sand, which is constantly falling in cascades from the rotating vanes.

The dried sand, as it pours out from the outlets of the drying chamber, is particularly hot, and in this condition is unsuitable for direct use; this factor presents a difficulty where the drying plant is not sufficiently large enough to provide for the building up of a stock of cooled sand. To overcome this obstacle, which can prove a serious drawback under a sudden call for an increased quantity of sand, additions to the plant were made to provide for the conveyance of sand direct from the drying-chamber to the foundry by blowing through pipes.

The hot sand, as shown in Fig. 2, falls immediately from the drying-chamber into a hopper, and from there it is elevated to a fairly large hopper supported upon four trunnions. At the narrow base of this receptacle sand can be made to flow at any predetermined rate by the movement of a small trap gate, and from thence through an inclined sieve which removes seashells and seaweed, etc., into a smaller hopper which passes into the injector pipe connected to the main pipe line. The pipe line, shown in Fig. 3, is 230 ft. in length and is carried upon upright supports to the roof of the foundry and leads into a suitable cyclone, below which

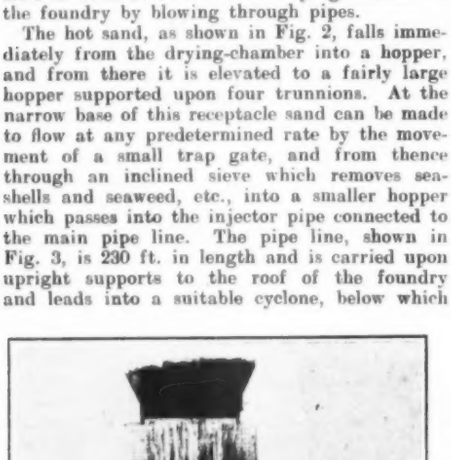


Fig. 2.

a 12-ton storage bin is fixed. The sand is conveyed through the pipe line by means of air blown in at a low pressure of 9 oz. per sq. in. from a high-speed fan fixed at the delivery end. The success of this operation depends upon a perfect mixing of the sand and air in the form of a sand-storm and the velocity of its passage. The injector pipe is of special construction and allows only a defined quantity of sand to be admitted in relation to the volume of air delivered. In this way the maximum weight of sand is delivered along the pipe into the cyclone, where the air and sand are separated, the latter falling below in the bin provided. During the passage of the sand the separation of the grains which takes place entirely dissipates the heat originally held, and cold material is supplied ready for use. From the storage bin, pipes are connected to small metal box measures fixed at the back of each sand-mixing machine, an arrangement which provides a ready method of filling the mills with correct measures of sand.

General Notes on Oil-Sand Binders.

Two properties generally required of oil-sand binders are, first, that green-bond strength should be given to the sand to enable the desired shape to be made, and, second, the resultant cores after baking should possess permeability and strength without any such objectionable characteristics as taking up moisture from the air. Oil alone is incapable of giving both these properties, so that other additions have to be made in order to produce the necessary strength to maintain the core shapes until finally set through drying. Water is a considerable help in this direction, so the crèmes of various compositions are on the market and find a ready sale. These consist of anything up to 40 per cent. water, the permanent emulsion being produced by the addition of a fair proportion of the residues obtained after pressing out the oil from the seed. These residues can be obtained from all seeds during the process of extracting the oil and contain mainly the meal from the seed, moisture and dirt. The appearance is of a semi-solid nature, dark in colour, but contains little or no oil; rather is it made up of albuminous compounds with carbo-hydrates (starch, mucilage, fibre, etc.) contained in the original seed. The addition of water to such residues instantly produces a yellowish-looking emulsion in the presence of a vegetable oil, to which is added in some cases a proportion of dextrine or core gum. Such residues can be mixed with oil and used direct without any addition of water and produce excellent green-bond strength in the sand mixture and, finally, splendid cores after baking. Materials such as molasses, rosin and dextrine are well known, but in each case the presence of water to any appreciable extent destroys the green-bond strength of the main mixture.

Core Drying.

No other detail of core-making is of greater importance than the question of drying, yet with what indifference is the process carried out! Even technical men are not immune from a misapprehension in this direction, for results have been published showing the measure of quality on an oil-sand mixture in terms of its tensile strength. Is the tensile strength of a core as important as some would like us to believe? It is somewhat difficult to visualise a core so placed in a mould where it is subjected to any great tensile strain, and it is rather difficult to appreciate the value of any interpretation which may be placed upon such characteristics in view of the fact that the tensile strength can be varied within a very wide margin by the degree of baking. Three factors in core-drying are each of equal importance:—(1) The temperature at which baking is carried out; (2) the nature and colour of the dried core; and (3) the amount of volatile matter left in the core. Singularly enough, the first factor dominates the remaining two, for if the correct temperature of baking is consistently maintained, then it follows that the resultant core will neither be too hard nor soft, and, further, the maximum amount of volatile matter will have been driven off short of causing the sand to "murl" by overheating. How is the correct temperature, therefore, to be determined? Practical experience on the point is undoubtedly invaluable, but if confirmatory results can be obtained by any technical experiments the same must be welcomed. To this end the following experiments were carried out ostensibly to determine whether there was any specific point in the temperature scale at which a change took place.

It was found that by taking a sample of linseed oil, little or no change took place on subjecting to increasing temperatures up to 250 deg. C. At this point a great change was noticed in the molecular weight, the viscosity and the density, and so great was the alteration in the physical nature of the oil at this temperature, particularly as indicated by the viscosity, that this temperature was adopted for practical experiment in the core-drying ovens. Sufficient confirmation was forthcoming at an early stage by the fact that the usual times occupied in drying were cut by half. The nut-brown colour of the cores, which persisted throughout the mass, indicated that the drying time and temperature had been effective and this, in turn, had driven off the largest proportion of volatile matter. Foundrymen must bear in mind that volatile matter which is not driven off in the drying ovens must be driven off when the metal is poured around the cores.

Core Ovens.

Correct temperature alone will not assure success, however, in this direction, the heat within the stove must be evenly distributed in order to give regular results at any given point.

Are your stoves properly constructed? Or, are you satisfied with any kind of arrangement, which when the door is shut a certain volume of heat is confined, the temperature of which is difficult to control or, perhaps, uncontrollable? If this is the case, then the direction of the wind controls the success of the core-baking to a greater extent than the fire-beater.

A well-laid-out system of core ovens is money well invested, and foundrymen are well advised to be guided, but not altogether blindly, by specialists in this line of building. Fig. 4 shows briefly an original alteration to the arrangement of flues underlying a battery of four drying ovens. Cores can be dried very quickly in this type of oven—bulky shapes up to 6 or 7 cwts. in weight can be dried in 1½ to 2 hours. The secret is the distribution of the heat, which is directed from the main flue to one branch flue in each oven, running in close proximity to one of the side walls. Three or four openings are arranged by which the quantity of heat entering any part of the oven at this side can be controlled by a simple movement of a flat damper plate. In the opposite side of the oven and likewise running the whole length is a similar flue, with openings which can be controlled,

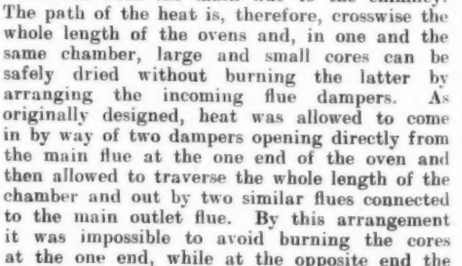


Fig. 4.—Plan of Core Drying Ovens.

connected with the main flue to the chimney. The path of the heat is, therefore, crosswise the whole length of the ovens and, in one and the same chamber, large and small cores can be safely dried without burning the latter by arranging the incoming flue dampers. As originally designed, heat was allowed to come in by way of two dampers opening directly from the main flue at the one end of the oven and then allowed to traverse the whole length of the chamber and out by two similar flues connected to the main outlet flue. By this arrangement it was impossible to avoid burning the cores at the one end, while at the opposite end the drying process was only in its initial stages.

New Companies.

Styrian Steel Company, Limited.—Capital £5,000. Subscriber: A. Bell, 52, Kennedy Road, Woodseats, Sheffield.

George Wailes & Company, Limited, 382-388, Euston Road, London, N.W.1.—Capital £20,000 in £1 shares. Ironfounders, etc.

Arthur Bridgens, Limited, 112, Arundel Lane, Sheffield.—Capital £1,000. Brassfounders, etc. Governing director: A. Bridgens.

Perkins & Powell, Limited, 2, Bartholomew Row, Birmingham.—Capital £7,000. Brassfounders, etc. Directors: Mrs. C. M. Powell and R. S. Powell.

British and Dominions Feralloy, Limited.—Capital £40,000. Iron and steel manufacturers, etc. Directors: C. P. Sandberg, Lewins, Crockham Hill, Kent; O. F. A. Sandberg and N. P. P. Sandberg.

The Production of Foundry Coke.*

By A. E. Taylor, B.Sc., A.I.C.

The present-day demands of any industry are such that when a trade depression occurs numerous unforeseen problems present themselves which, viewed from a technical standpoint, have to be solved by rational and scientific methods, in order to overcome keen competition at home and abroad.

So it has been with the coal and coking industries, and within these last eight or so years an enormous amount of time and labour has been expended on research into the various branches of fuel technology. This, of course, is an endeavour to re-establish our position as the power country of the world, and to keep ourselves on a level with other countries in the development of processes intimately connected with coal utilisation and its by-products. The production of coke occupies no mean position in these activities, and although the trend of modern development in the coke and by-product industry has been actively concerned with by-products, the main product of the process, namely coke, has recently been the subject of much scientific work.

The original objective of the old bee-hive oven was to produce a fuel suitable for blast furnace and cupola work, to compensate for the already sadly depleted stocks of timber, which had until then been used as fuel by the pig-iron manufacturer and the smelter. Following this came the first attempts at by-product recovery, with corresponding improvements in the plant concerned; consequently the by-products became of the utmost importance in the economic administration of the process.

The demands of the blast furnace and cupola for a suitable fuel had however to be met, and it is encouraging to note the institution of numerous research stations throughout the country which deal almost entirely with the scientific production and utilisation of coke. Huge batteries are at the present operating on the Continent and in America and to a lesser extent in this country, where construction has been so designed as to give large throughput and to produce a coke the properties of which shall meet the requirements of furnace and foundry manager.

A number of factors enter into this important question, amongst which may be mentioned: Temperature of carbonisation, width of oven, cleaning and blending of coal, sizing and screening of coke. It is within our province to discuss what effect these factors have on the properties of the resulting fuel, considered from the point of view of its utility as a material suitable by its combustion for the melting of pig-iron.

Temperature of Carbonisation.

This factor is naturally governed by the temperature of the heating flues, which are so designed in modern practice as to give something between 1,100 and 1,350 deg. C. This latter temperature, approaching as it does to that employed in cupola practice, is a moderately high figure. It speaks well for the recent development of construction that ovens are capable of maintaining a uniform distribution of heat at this temperature throughout their length and height. This may seem the more remarkable from the fact that some of the latest ovens are 40 ft. in length and more than 11 ft. in height of the coking chamber.

This question of temperature is intimately connected with rate of heating, which itself depends on flue temperature, conductivity of walling material, width of coking chamber, moisture in coal, and the speed at which the charge of coal of itself transmits heat from its outer to inner layers. Uniform heating is essential if a material is to be produced of uniform physical characteristics.

In the older batteries it was a common occurrence to have a much higher sole temperature than that obtaining at the top of the flues, with the consequence that the power regions of the coal charge became coked at a period in advance of the regions above. It can then be understood that a tendency to have high bottom heats exists unless extreme care is taken in the calibration and adjustment of the Jen nozzles.

The whole of the charge must, however, be coked, and when these high sole temperatures obtain the charge must be left in until the top has been coked off, with the result that the bottom becomes overcoked with serious and disastrous effects upon the properties of this portion.

One method of avoiding this has been the adoption by Koppers of his well-known oven with the vertical taper. Here we have a coking chamber wider at the bottom than at the top—only a matter of inches of course, but it produces the desired effect in that almost the whole of the charge is brought to an ultimately coked condition at the same time. In other words, the plastic layers which travel inwards from the heating walls to the middle of the charge tend to melt at a time which coincides at the top and bottom of the oven. This question of plastic layer will be dealt with when treating of porosity of the coke.

It has been found that one and the same coking coal yields a product of varying properties when coked at different speeds. The important function here is width of oven.

The Oven-Width.

Quoting from a technical journal as far back as 1896, we find "with poor and non-coking coals, a high temperature rapidly and evenly distributed throughout the coal was an essential feature of efficient coking." It will readily be understood that the narrower the oven, the greater will be the rate of heating, other factors remaining constant, with a resulting increase in throughput.

At the present time attention is being directed to the possibility of producing a satisfactory coke from certain very high volatile and semi-bituminous coals, normally considered unsuitable for coke-making purposes, by employing narrow high-temperature ovens. This method was demonstrated by Carves before 1890, when he constructed ovens varying in width down to 14 in. The results of his experiments show that he was able, in a number of cases, to produce a satisfactory coke from coal previously classed as non-coking; his work in this direction was, at the time, interesting from an academic rather than a commercial aspect, because, financially, it was more advantageous to use or purchase the then easily obtainable coking coals.

Francois Carves worked on the principle that no particular dimension of oven was universally applicable, but that each individual coal and installation should be investigated and designed to meet its own peculiar conditions. One feature, however, he always insisted on: "A high temperature rapidly and evenly distributed throughout the coal." What, then, are the effects of varying the rate of heating? Amongst others, for a given coal, an important effect is that on the mechanical strength and porosity of the product.

There is a stage during the heating of a coking coal from ordinary temperatures to something over 600 deg. C., when the coal assumes a sticky or plastic nature, depending upon the relative amounts of the resinic or humic constituents of the coal. This temperature is generally between 350 to 450 deg. C. It can be conceived that at this temperature the small coal particles become coated or liquated with a film of primary tar, which ultimately fills up the interstices between neighbouring particles.

Further increase in temperature brings about further destructive distillation of the coal mass, with the result that the gases formed have to find a way out and force themselves through this film of fluid matter, forming to a greater or lesser extent minute bubbles, when coal naturally swells. A little consideration will reveal the fact that by varying the time over which a given layer of the coal charge is allowed to remain in this plastic state, the size of bubbles or voids in the resulting material will also vary, producing cokes of high or low porosity with varying thicknesses of cell wall.

What has this to do with coke and the cupola? Obviously a coke with a high porosity will not be so mechanically sound and resistant to abrasion as one with a lower porosity, and a further effect is that changes in reactivity and combustibility are brought about. These latter terms, it must be frankly admitted, are of a somewhat elusive nature, and energy is being expended in research, determining the effect of their variation upon the consumption of fuel, more particularly in connection with blast-furnace practice. There is no doubt that they do play an important part in the function of the coke used in cupola practice, the object of which is to melt iron by the production of heat from the combustion of the coke. Reactivity and combustibility play no minor part in determining the degree of heat and the speed at which this is attained.

Width of oven, then, is of radical importance from the point of view of coke produced. Prior to the war and to-day, of course, in the old batteries, coke was produced in ovens of a mean width of about 23 in., furnishing useful material.

We were in those days dealing with the finest coking coal available, and, with gradually depleting stocks of this material, coals of varying properties have to be carbonised. During these past five or six years oven width construction has fluctuated from the wide to the ultra narrower, until at present the general tendency is to build at about 17 to 18 in., coking a charge of anything between 10 and 12 tons in a period of about 18 hrs.

Size and Screening of Coke.

Coke is naturally smaller from narrow ovens, for the simple reason that the length of the largest pieces can only be equal to half the oven cross-section. Furthermore, in those cases where coke has been produced from a coal in wide ovens, when the same coal is carbonised in a narrow oven, we have higher degree of cross fracture.

To what extent the size of coke governs fuel consumption is a question which can only be answered by foundry managers in active co-operation with the various research institutions. We are all aware that conditions vary inordinately in different cases, but there can be no doubt that size of coke plays an important rôle. In the light of modern advances in coking, coke handling and screening, there should be no difficulty in supplying the size demanded by the cupola man.

The furnace people have realised that size of fuel is important, and this, coupled with the question of smoke abatement and the increased use of the small coke sizes both for domestic purposes and central heating of large buildings, has led to the solution of the coke-screening problem.

There are numerous coke-screening plants on the market to-day, including revolving screens, grizzly screens, jigging screens and vibrating screens. All are more or less efficient, varying in maintenance costs, amounts of small produced

* Paper read before the Wales and Monmouth Branch of the Institute of British Foundrymen, Mr. R. G. Williams presiding.

by attrition, and cost of power; probably a combination of grizzly and vibratory screen would represent the ideal.

Dry Cooling.

In this connection may be mentioned a modern method of coke quenching, namely, dry cooling, in which the sensible heat of the hot coke is utilised by passing inert nitrogen through the hot mass and generating steam with the aid of the hot gases produced. Apart from a more efficient heat balance on the plant, this less drastic method of coke quenching has the effect of reducing cross-fracture in the coke—a decided advantage over the more generally used water-quenched method.

Furthermore, the moisture content of the coke is nil, unless a predetermined small percentage of moisture is added after dry cooling to minimise the dust nuisance. One thing the cupola man does not want to pay for as coke is water, and there is little doubt that the method of dry cooling will be generally adopted in this country when we can be made to realise its benefits. But, instead of leading the way, we shall only be following the example of Continental competitors.

Blending of Coal.

The supply of first-class coking coal will inevitably fail some day, and the longer we are able to conserve our supplies, the better for the industries concerned. South Wales is favoured with a coking coal second to none, and one fails to see reason in the drastic consumption of this supply *ad lib* without making some effort to blend with it a proportion of the more feebly coking qualities, provided, of course, that the properties of the resulting coke are not to any great extent badly impaired.

This question of coal blending and the utilisation of inferior slacks is receiving far more attention on the Continent than in this country—obviously, because there they do not possess the quality coal that we do. But, obviously, this supply is not inexhaustible, and, if it is possible to blend two or more (sometimes fifteen or sixteen) varieties of inferior coals with good results, surely the problem is lessened in difficulty when one of the constituents is of excellent quality.

Blending is intimately connected with the cleaning of coal, and numbers of eminently successful types of washing plant are in operation dealing with all coal sizes down to the one-time unwanted dust and slurry. A notable advance during the last year or so has been the inception on a manufacturing scale of the dry-cleaning plants. The consumer of coke has no more use for water in coke than the coke-oven manager has for water in the coal charged to his ovens. This water is simply an inert, has to be driven off, increases the coking period and impairs the quality of his coke.

Dry-cleaning, then, although beset with the gradually vanishing dust problem, is very likely in the near future to become a serious rival to the wet process, provided the cost per ton can be shown to compete favourably.

Blending is usually carried out with the aid of travelling belts and revolving tables at the washery before bunker storage, and by suitably blending and efficient washing; numerous seams of coal otherwise untouched for the production of metallurgical coke could be utilised, yielding an entirely satisfactory product for foundry purposes.

Clean coal is essential, *cela va sans dire;* the cupola man cannot be expected to pay for ash, which simply acts as a diluent during the melting process.

Calorific Value.

This physical property of the fuel depends to a large extent upon the fixed carbon content of the coke, which in its turn is dependent upon the carbon, volatile, and ash content of the coal carbonised.

Closely allied to the effect of calorific value, which naturally varies in different cokes, is the difficult problem of reactivity and combustibility. Obviously, whether the carbon of the coke burns with oxygen or carbon-dioxide, it is temperatures that the cupola man wants, and temperatures in the right place. Calorific value, reactivity and combustibility each play their share in determining what the temperature shall be and have their consequent effect on operating costs.

In a summary of some recent German work there appears the statement that auxiliary coal-powder firing, which has been introduced into foundry practice of recent years, has proved very satisfactory. The advantages gained by this method can briefly be summarised as follows:—(1) Considerable saving of coke, (2) increased output of the furnace, (3) increased temperature of the molten iron, and (4) reduced carbon and sulphur contents, which results in better mechanical properties of the castings. The considerable saving of coke is of considerable interest. This statement is amply verified in the experimental data given, and savings of as much as 30 to 35 per cent. of the melting coke are indicated, the bed coke being constant in each case.

The coal-powder is introduced into the furnace with the aid of compressed air, by tuyeres, which are regularly distributed in the circumference of the furnace at the height of the melting zone. The number of tuyeres is from two to four according to the diameter of the furnace, the air pressure is from 4.4 to 6.5 lbs. per sq. in., and its quantity 32 to 48 cub. ft. per lb. of powder.

According to the figures given, the quantity of coal-powder which must be added is from 0.7 to 1.0 per cent. of the iron charged.

In addition to the reduction of fuel consumption, there is an influence of the chemical composition of the molten iron, and in spite of the lower coke consumption, when coal powder is used, the temperature of the iron is somewhat increased—there being no difficulty in reaching a temperature of 1,400 deg. C. There is furthermore a better thermal efficiency of the cupola, given by the heat balance when using coal powder.

This indicates but one attempt at reducing coke consumption, but in this instance there is no connection with the coke itself.

In conclusion, it will probably be agreed that the burden to be carried in foundry practice is different from that in the blast furnace, no reducing action being necessary, and that the function of the coke is purely thermal.

The qualities desired then, in coke for such practice, are a high calorific value, and hardness to stand the burden and severe abrasion with the pig-iron. A dense, non-friable, well burnt, correctly sized coke is therefore considered necessary. The factors governing the importance of sulphur, phosphorus, ash and water content are the same as with blast-furnace coke.

It is with the object of formulating some such definition that the work at the various research stations has been undertaken. As in all other industries, there is room for improvement in cupola practice, and with the necessary co-operation between an intelligent coke producer, the consumer and the research worker, this will undoubtedly be made manifest.

DISCUSSION.

Mr. Hird, in opening the discussion, said he quite agreed that a great deal of thought had to be given to the matter of coke, which often had to take far more than its fair share of blame if anything went wrong in the foundry. He asked which portion gave the proper coke. Was the underbaked or the overbaked?

Mr. Taylor replied that the charge of coke was not pushed until the top was charged to their satisfaction, therefore the top was better than the bottom. The coarse fracture at the bottom is increased, due to over burning. The reactivity of coke should be explained as the speed at which it burns in carbon dioxide, the combustibility is the speed at which it burns in oxygen. These are factors of importance in the method of fuel consumption, and it must be remembered that overburnt coke undoubtedly has a lower reactivity than an underdone coke. If reactivity plays an important part, it is better to make an underdone rather than an overburnt coke.

Mr. McClelland thought the reactivity question an important one for this reason. As a foundryman using coke he had found there was a considerable gap between opinions expressed as to the value of reactivity. He wished to ask a question which might be outside Mr. Taylor's experience. Had he ever tried to find the correct amount of oxygen which should be admitted to the cupola to obtain the greatest calorific value? There was a difference of opinion as to the number of cub. ft. which should be allowed per cwt. of coke, varying from 20,000 to 35,000.

Mr. Taylor said he was afraid he could not answer this question. It was a normal practice when using an economiser to allow 150 per cent. excessive air for efficient combustion.

Mr. McClelland said he knew of one maker who claimed that 30,000 cub. ft. air to one cwt. of coke was the best figure for obtaining the greatest calorific value. There is a limit which must not be exceeded or sluggish metal and a high coke consumption will result. In 1875-6 coal had to be used. Could Mr. Taylor give the young men present the reason why coke was better than coal?

Mr. Taylor replied that with coke there was a concentrated form of carbon, with the result that heat was produced in a given zone. In coke the heat was supplied in the bed, and no volatile matter had to be driven off. The heat was then distributed further up the body of the cupola. In the coking process a certain amount of sulphur and phosphorus was eliminated, and this was an advantage gained by the use of coke. The chief reason was the concentration of carbon. In South Wales coal, there is from 55 to 65 per cent. carbon, whereas there is 88 to 94 per cent. fixed carbon in coke.

Mr. McClelland asked if it was possible for coke to retain more sulphur than was beneficient.

Mr. Taylor said there was a good deal of sulphur given off, and a fair amount was present in household gas, representing the sulphur in coal. Some compounds pass off in tar and part of the sulphur was eliminated in the wet quenching of coke. It was possible to smell the H_2S. Generally speaking, there is less sulphur in coke than in coal, and the type left in coke was of the fixed type and not so liable to contaminate.

Mr. Richardson wished to know the reason for recovering slurry, and if coke made from this was as good as that made from coal.

Mr. Taylor replied that slurry was the bugbear of the coke man. The quantity produced by means of the wet process was enormous. This naturally found its way into the water in the washery. The ash content of the slurry in South Wales would be anything from 18 to 20 per cent. This slurry had to be utilised in some way, and in the past it had been used as a boiler fuel. The plant used for washing slurry was not more or less than a baby washer. The ash in a small recovery was in the region of 10 to 12 per cent., which could be mixed with already washed slack. The material which then comes away from the washer as refuse can be used in the boiler.

Referring to dry washing plant, Mr. Taylor said here there was no slurry. There were two types of dry washing plant—static and pneumatic, through which the air pulsated and the lighter particles were separated. The difficulty here lay in the trapping of all the dust, and complaints were often lodged against the plant. Dry cleaning could not entirely deal with fine slurry

particles. Mr. Deaking in the tour of inspection had said the finer the coal the more mechanically sound was the coke, but Mr. Taylor did not think this was the generally accepted view.

Mr. Hird asked Mr. Taylor for his opinion about the presence of ash in coke, especially when the ash had a low slagging temperature.

Mr. Taylor replied there was a tendency to demand a fusibility of ash. A fusibility of ash would naturally result in enclosing certain valuable particles of carbon.

Mr. Hird asked whether coking at a higher temperature would give better results.

Mr. Taylor said the ash would remain in the coke as determined by the ash in the charge.

Mr. Morris asked how much attention had been given to the important question of trying to eliminate more sulphur. Was it possible in dry cooling to pass some gas through, which would eliminate more of the sulphur, and further, why was it possible to weld iron with soft coke and not with hard? Was there any binding material which could be used with coke breeze?

Mr. Taylor replied that coke breeze would gradually be eliminated, and he knew of no binding material. Some people replaced the small size breeze and put back into the oven with the charging coal. This had a deleterious effect. He could not explain why one coke facilitated welding more than another. The difference between hard and metallurgical coke resulted from the difference in the temperature at which the coal charge was distilled.

Sulphur and the question of its elimination had undoubtedly received much attention. One suggestion was the steaming of retorts. The passing of steam through the charge would eliminate sulphur, but as coke ovens were horizontal, this could not be done. Wet quenching eliminated part of the sulphur but dry cooling did not. The passing of gas, such as nitrogen, would have very little effect upon the elimination of sulphur.

Mr. Rees, of Bristol, asked whether Mr. Taylor had any experience of the bee-hive oven and whether its claims were justified.

Mr. Taylor said there was the same question of temperature. There never would be anything to coke like the old bee-hive. If the blast-furnace man could get bee-hive coke he would take it every time.

Mr. Richardson: Could you tell us the percentage of water we are buying?

Mr. Taylor stated this would be 8 to 9 per cent., but the guarantee should be 2 per cent.

Mr. Jones said with a regenerative oven there was an advantage of 50 per cent. waste gas. It was very well to get 50 per cent. extra gas, but one had to have a market for it. Speaking of experiments made at Ebbw Vale (as regards sulphur) with bee-hive ovens, steam at the bottom took away quite a deal of sulphur. Referring to refractories, it was a general practice in America to substitute silica for fireclay linings. Was there any real advantage? Fireclay bricks are cheaper. When using small coke breeze, was not pulverised coke used?

Mr. Taylor in reply said that he had no experience of pulverised coke. Steaming was not carried out in modern coke ovens. It could not be done. In the case of a vertical oven it was possible to arrange something in the manner of tuyeres, and in gas-making plants this would be satisfactory.

Answering the second question, Mr. Taylor said silica bricks were certainly better. There was a silica-lined plant being erected at Bedwas and one existed at Bargoed. These were the only two in South Wales. Here it is not necessary to use so high a temperature as that necessary in coking some of the high volatile coal in the North and Midlands. In many fireclay batteries the working temperature is 1,350 deg. C. The idea of silica batteries is to be able to work at a higher temperature. A charge can be coked at 1,350 deg. C. in less time than a charge at 1,050 deg. C.

Mr. Hird asked why some coke looked bright and others dull.

Mr. Taylor replied that the lustre was due to carbon, which had deposited in the cells of the coke by the decomposition of CH_4. The carbon which came from CH_4 accounted for the brightness. Coke over quenched was also dull.

Mr. Kinsman asked would an underdone coke be soft or hard?

Mr. Taylor explained that, assuming one had a temperature of 1,350 deg. C. if the charge was left in for complete distillation, say 22 hrs., all volatile would be driven off. If left in for 18 hrs. the coke would be underdone.

The meeting concluded by a vote of thanks proposed by Mr. Kinsman and seconded by Mr. Richardson.

Gas Cylinders.

APPLICATION OF ALLOY STEELS.

The Third Report of the Gas Cylinders Research Committee (Alloy Steel Light Cylinders) issued by the Department of Scientific and Industrial Research states that before drawing up a programme of research into the subject of alloy-steel light cylinders both steel manufacturers and cylinder manufacturers were consulted. A questionnaire was prepared and forwarded to eleven firms, who were invited to specify the chemical composition, heat treatment and mechanical properties of alloy steels which in their opinion would be suitable for the purposes in view. Suggestions were received from four firms, one of which recommended a nickel steel, two a nickel-chromium steel, and one a nickel-chromium-molybdenum steel. With the exception of the low limit of proportionality found for the nickel-chromium-molybdenum steel, the results of the mechanical tests were thought to be reasonably satisfactory, and it was considered that if these materials could be successfully worked into seamless cylinders they would be suitable for the purpose of the investigations.

Nature of the Tests.

The tests included (A) Internal water-pressure test to destruction, with determination of the limit of proportionality; (B) mechanical tests—(*a*) on complete cylinders, (1) drop-test on charged cylinder (rough-handling test), (2) flattening test on whole cylinder; (*b*) on specimens cut from a cylinder, (1) tensile tests on longitudinal strips, (2) cold-bend tests in two directions; (C) firing test; (D) chemical and metallurgical tests, (1) chemical analysis, (2) examination of microstructure.

The firing test, which has been developed at the Royal Aircraft Establishment, is for the purpose of determining whether the material of the cylinder is liable to disperse in fragments on being perforated by a bullet.

Results of Tests.

Nickel-Steel Cylinders.—Of the twelve cylinders of nickel steel ordered, only eight were found suitable for testing, the remainder having failed in the drawing operations. Of these eight, two were sent to the Royal Aircraft Establishment for the firing test, and the remaining six were tested at the National Physical Laboratory. The results of the mechanical tests were considered to be satisfactory. The internal bursting pressure (mean of two cylinders) was found to be 312 atmospheres, the factor of safety for bursting being 2.6.

In the firing tests, one of the two cylinders burst on being hit, with complete wreckage of the cylindrical portion, and the head was blown off. The microscopical examination of the metal of the cylinders indicated overheating during hardening. The chief objection to the nickel-steel cylinders was, however, the method of formation of the neck, which consisted in welding a piece of steel to the main body of the cylinder. This was unacceptable for two reasons:—(1) That a welded joint in a cylinder with such a high working stress as that proposed was undesirable; (2) that the method produced a ridge inside the cylinder at the junction, from which it would be difficult, if not impossible, to remove foreign matter.

Nickel-Chromium-Molybdenum Steel Cylinders.—The difficulties encountered in the manufacture of the nickel-chromium-molybdenum steel cylinders were such that twelve months elapsed between the placing of the order and the date of delivery. Ten of the cylinders were sent to the National Physical Laboratory for mechanical and metallurgical testing, and the remaining two, together with two cylinders of the same description made by the firm for the Mount Everest Committee, to the Royal Aircraft Establishment for the firing test.

The satisfactory features brought out by the tests were:—(1) Mechanical tests—Bursting pressure (mean of two cylinders), 266 atmospheres; factor of safety for bursting, 2.2; pressure at limit of proportionality, 240 atmospheres; ratio of this pressure to working pressure=2.0. The values for the bursting pressures were appreciably less than the corresponding values in the nickel-steel cylinders. The other mechanical tests were all satisfactory.

The unsatisfactory features were:—(1) Firing test; two of the four cylinders burst; (2) the thickness of the walls of the cylinders did not lie within the prescribed limits, and was at one place as much as 26 per cent. under the thickness specified; (3) a marked folding of the material had taken place at the shoulder of the cylinder during the formation of the neck. As a result of this folding, a network of microscopical cracks was discovered in the inner surface which extended for a considerable distance through the section of the neck.

It was decided therefore that cylinders of nickel-chromium-molybdenum steel could be recommended for use in special circumstances. It should also be pointed out, states the Report, that the fact that only one material is recommended as suitable for light cylinders is due to the construction difficulties of manufacture. In the design of such light and small cylinders the working stress of any material which it is proposed to use should be determined not only from its mechanical and metallurgical properties, the possibilities of its manufacture into cylinders having a reasonably uniform thickness of wall and freedom from folding in the neck, but also from information as to its tendency to fragment given by the firing test.

The chemical composition of the steel used should have the following composition:—Nickel, 2.5; chromium, 0.6; molybdenum, 0.6; manganese, 0.6; carbon, 0.3; silicon, 0.15; sulphur, 0.04 max.; phosphorus, 0.03 per cent., the balance being iron.

"John Surtees Memorial" Competition.

The Newcastle Branch of the Institute of British Foundrymen held the junior competition in connection with the above memorial in March, and the local governors have made their awards as follow:—First prize (including the silver medal), Mr. E. Christie; second prize, Mr. A. Ternent; third prize, Mr. E. J. Hudson; fourth prize, Mr. J. Mills; consolation prizes, Mr. T. Brass and Mr. T. M. Tate. The following were highly commended:—Messrs. J. B. Slassor, W. Manners, J. J. Jordan and M. D. Atkinson.

The prizes will be presented to the successful candidates at the annual meeting of the Newcastle Branch, to be held on April 27 at 6.15 p.m. in the Neville Hall, Newcastle-upon-Tyne. Fifteen candidates presented themselves for the examination, which consisted of two parts—practical and theoretical foundry work.

Annealing of Cast Iron.*

At the conclusion of the lecture, the Chairman said they had had a most illuminating address. The three points that Mr. Beeny seemed to have brought out more particularly were the time, temperature and—what was perhaps most essential—knowledge of the composition of the iron that was being annealed. He agreed that the promiscuous hardening of cast iron was a very bad practice; they must have a knowledge of what they were doing.

Mr. H. J. Young thought that the Paper had a misleading title. He did not think that "annealing" was the correct word to use. It was undoubtedly heat-treatment, and one capable of being developed much further; for instance, Diesel engine people often "annealed" their castings, but the last thing they wanted to do was to alter structure. Their main object was to find the temperature at which the structure was *not* altered and the graphite in particular *not* affected. Mr. Beeny had convinced him of one thing, that it was never good policy to make white cast iron and then turn it into grey. In castings for the glass industry a high silicon iron was used, with the result that a chilled surface was obtained also, what was in his opinion falsely called a "graphite eutectic." Two years ago an attempt was made to take out a patent in this country for the casting of iron between chills in order to produce this graphite-eutectic. That application did not succeed. During heat-treatment of cast iron he had found that the penetration of air was the one thing to be avoided; his and Mr. J. E. Fletcher's process consisted of plunging the metal into a bath of molten tin or lead, quenching being done in another bath. Under those conditions iron that gave 15 tons tensile and 200 Brinell could be turned into iron giving 30 tons tensile and 350 Brinell, which was just as machinable as ordinary cast iron. The lecturer's process did not carry heat-treatment to finality. 850 deg. C. was not a very economical temperature in practice. In ordinary works, they found people annealing castings and turning them sometimes blue and sometimes pink, but the results were generally unsatisfactory, which, as Mr. Beeny had pointed out, must be the case when they did not know or understand the effects of composition. In conclusion, the speaker said that Perlit irons to resist great heat should have about 0.5 or 0.6 per cent. or less of silicon.

Annealing or Heat Treatment?

Mr. Beeny said that he would describe Mr. Young's method of heating iron under molten tin and lead and quenching it in another bath as heat-treatment, and what he had spoken about by comparison with that he thought could be called annealing. Certainly the distinction between the two was not very marked, but if the experiments which had been carried out on the sand-cast bars were not annealing he did not know the meaning of that term. It was not a very material point, but in spite of what Mr. Young had said he thought the title of his Paper was justified. He quite agreed with Mr. Young that there was no advantage in chilling metal white. He was not aware that such a process was being used commercially anywhere. In his reference to America he really had in mind the Holley castings, which were grey when they were cast and not white. He was quite sure that no good strength properties could be obtained by very severely chilling metal which should normally be grey in order to make it white, simply because the shrinkage became so great that they could never get it sound, and the solidification was so rapid that they could never hope to feed into the sections of the castings. Moreover, surface flaws were invariably present to some extent. The best results were obtained when the chill was quite superficial or entirely absent.

His reply to Mr. Young's query as to the object of chill casting was, that it was a means of obtaining a great increase in strength from relatively cheap high-silicon irons. The metal could be cast in bars of various diameters. They could have a bar nine inches in diameter cast absolutely sound and dense right to the centre from such metal. After annealing the bars could be used for machining out small parts. There were other uses. Where the cast was made in a permanent or semi-permanent mould, provided the mixture could be properly controlled, they would obtain a grey structure with the graphite extremely finely distributed. He did not think that chill casting, provided the chill was not too deep, required any further justification; it had its uses, and he believed that as mass production developed it would come into still greater prominence. [Mr. Young explained that he was not against chill casting; he was referring to chilling white.] Mr. Young had said that 850 deg. C. was not an economical or suitable temperature for use in works. For many years, said Mr. Beeny, the firm with which he was associated had used that temperature for annealing grey-iron castings, where annealing treatment was advisable. It was very much easier to maintain, in an ordinary furnace, a *uniform* heat of 850 deg. C. than a temperature of, say, 450 deg. Therefore he would say that, as a matter of convenience and practical working, 850 deg. C. was an easier, though not a more economical, temperature than 450 deg., and he could see no objection to using it in works practice.

Analogy with Malleable Practice.

Mr. Dews, after expressing his appreciation of the subject matter and the charmingly intimate style in which the lecture had been delivered, said he was surprised that Mr. Beeny, in his summary, had said he did not think there was any prospect of improving the properties of the iron by chilling it white and annealing it grey. He (Mr. Dews) thought that was the basis of malleable work, and that the superiority of malleable over ordinary grey cast iron was that one obtained a very fine graphite structure through casting the iron white and annealing it grey.

Graphite Eutectic.

The graphite eutectic structure which the lecturer had shown had been the subject of a great deal of discussion lately, and it was very interesting to see this particular example, which Mr. Beeny had produced, in a chill, and if Mr. Beeny could produce that particular result in a green-sand casting from cupola metal, there was no doubt that he would have solved a very great number of problems affecting iron founders. Joining issue with Mr. Beeny, Mr. Dews said he was steadily coming round to the point of view put forward lately from several quarters, that the graphite structure was the controlling influence in cast iron. He thought that there the lecturer might revise his conclusion. Provided there were a favourable graphite structure, all-pearlitic iron would give a higher strength than one containing both ferrite and pearlite, but if the graphite were unfavourably distributed in a pearlitic iron, it may be considerably worse than a ferritic and pearlitic iron in which the graphite was favourably distributed. Mr. Beeny had paid attention to the graphite distribution to a certain extent, and if he would follow out the effect of annealing on the graphite formation, he would be able to read a good deal more into his results than he had already put forward.

Fundamental Differences.

Mr. Beeny, replying to Mr. Dews' doubts of the condemnation of white chilled iron, said that white malleable iron was not chilled within the meaning of the term, whereas in the last experiments described in the Paper the chilling was very severe indeed. The white structure was produced solely on account of the chilling. The metal went in and became solid right away, but when a much lower silicon and naturally white metal was cast into sand, as was the case in the malleable industry, a very much slower rate of cooling was obtained. This allowed greater soundness and produced an altogether different primary structure. In addition, there was an opportunity to feed the casting, because it solidified so much more slowly, enabling a sound job to be effected. Mr. Beeny could not completely understand why the white chilled iron gave such disappointing results, except, to a certain extent, in regard to the compositions used and, of course, the unsoundness.

Graphite Eutectic as a Decomposition Product.

In regard to the so-called graphite eutectic produced by chilling, Mr. Dews had remarked how satisfactory it would be if it were possible to produce this graphite eutectic when sand casting. One certainly would expect to get a genuine graphite eutectic by sand casting rather than by chill casting, because the sand casting gave a slower rate of solidification and a greater approach, therefore, to equilibrium conditions. That was what made him think the so-called graphite eutectic was not really a graphite eutectic at all, but a decomposition product. It certainly required more work before he would commit himself definitely on this point, however. He just put the structure forward as a matter of interest. He agreed with Mr. Dews that the graphite structure was the most important factor in regard to the strength of grey foundry irons. All his bars were cast at 1½-in. diameter, so that in no case was the graphite in a very damaging form. The flakes were all of moderate size. The slide shown, which was taken from a previous Paper of his dealing with the rates of cooling, showed something of the effect of the enlarging of the graphite structure, and the phosphide-eutectic network. As the rate of cooling became slower, so the transverse strength dropped; the combined carbon remained practically constant in all the bars, which varied from ½ in. to 1¼ in. in diameter; so he thought that that variation in strength was due mainly to the enlargement of graphite flakes and general structure with slower rates of cooling. He therefore agreed with Mr. Dews that it was necessary to have a good graphite structure initially. Having obtained that, the strength quality of the iron depended to a very considerable extent on the amount of combined carbon existing as pearlite; the lower the silicon the greater the variations in strength and combined carbon which could be had by altering the annealing treatment.

Importance of Manganese.

Mr. Kain said he hesitated to commit himself without studying the Paper, but it appeared to him that Mr. Beeny's object was to obtain a perfectly ferritic matrix with a view to easy machinability. If that were so, it was rather surprising that he should ignore the manganese. It was common knowledge that in black-heart malleable cast iron manganese was probably their greatest enemy; they were distinctly alarmed if the manganese was more than 0.3 per cent., yet many of the samples they had been shown on the screen contained 0.7 per cent. or more. A short time ago he obtained a material that was supposed to be black-heart that contained 0.7 per cent. manganese. It was given approximately 300 hours' heat-treatment at about 860 deg. C., and at the end of that time it was practically wholly pearlitic. He would like to know whether Mr. Beeny had formed any views on the subject and had taken the effect of manganese into account in his experiments.

Malleable Iron not Envisaged.

Mr. Beeny replied that they were dealing with general machinery irons and their anneal-

* Discussion on the Paper read before the London Branch of the Institute of British Foundrymen by Mr. H. H. Beeny, and published in our issues of March 28 and April 4, Mr. Wesley-Lambert presiding.

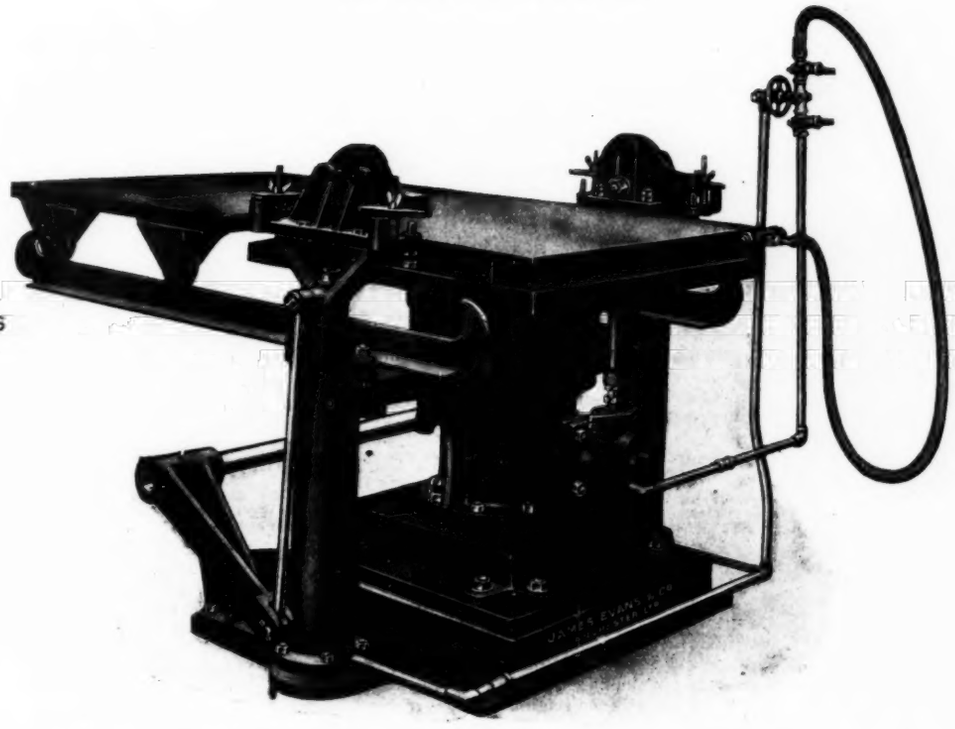
TYPE "C"

JAR RAM MOULDING MACHINE

with Turnover Pattern Plate.

For Pneumatic Power.

TWO MACHINES IN ONE.



UNSKILLED LABOUR ONLY REQUIRED.

The above machine illustrates a Jar Ram Machine with Turnover Pattern Plate which can also be used for Stripping Plate Work.

The machine has been designed to combine the two distinct features above mentioned, and is practically two machines in one, equally suitable for steel, iron, etc.

The machine as illustrated is arranged for work that requires turning over, such as steel moulding. And while the turnover arrangements are intended for general repetition work, by detaching the turnover plate from the trunnion brackets the machine can be used for stripping plate work by attaching the stripping plate to the trunnion brackets. Or, on the other hand, by removing the trunnion brackets as well, the table can be used for jolting general jobbing work.

A very important feature of the machine is the simplicity with which the intensity of the Jolt can be regulated when the operator has become accustomed to the use of the machine, which takes but an hour or so. The valves all being on the exterior of the machine are easily accessible, and there is an adjustable arrangement that will allow the jolt to be varied between 1½ in. to below ½ in. This being done without disturbing any part of the machine.

The machine is supplied with Withdrawal Carriage, Vibrator, and Blow-off Nozzle complete. It is substantially constructed to stand heavy wear and tear, and requires a minimum amount of skill to operate.

Another important feature of the machine is in the arrangement of the hard wood anvil block for receiving the shock. The blocks being carried well down the machine in a specially designed annular chamber give considerable relief to the foundations. It also provides against the possibility of fracturing the jolting table. Pitch pine blocks are also inserted between the foundation plate and the machine bedplate to assist in the relief on the foundations, and these features considerably improve the working advantages of the machine.

IT IS ALSO ENTIRELY OF BRITISH DESIGN AND MANUFACTURE.

JAMES EVANS & CO. (M/c) LTD.

Britannia Works, BLACKFRIARS, MANCHESTER.

ing; therefore, one naturally did not expect to find the low manganese that one had in an iron that was specially compounded for malleable castings. He agreed that the proportion of manganese did rise to as much as 0.7 per cent., but it did not vary very much in any of the irons described, so that, whatever effect it had, was approximately equal throughout the whole of the annealing experiments. While a 0.2-per-cent. difference might have a strong effect on the low-manganese metal which was used for malleable work, such a variation was not a great factor when they considered irons containing as much as 0.5 or 0.7 per cent. No doubt the manganese had an influence upon the stability of the pearlitic carbon. Opinions differed as to which way the manganese acted. Personally, he thought that its first action was in the direction of neutralising the effect of sulphur by forming manganese sulphide and that a proportion of manganese was used up in that way. Thus sulphur had a stabilising effect on the carbide, and if they had much sulphur present and only a small amount of manganese, first increases in manganese combined with the sulphur to form the inert manganese sulphide, and this produced a softening action. Further additions of manganese then increased the stability of the carbide, and thus had a hardening effect on the iron. Thus, in the machinery irons used, reducing the manganese down to at any rate 0.3 per cent. would have a tendency to render the carbide less stable and give more rapid annealing.

Mr. Wesley Lambert proposed a hearty vote of thanks to the lecturer, which Mr. Young seconded.

Mr. Beeny, in returning thanks, said he particularly appreciated Mr. Young's kind words after the somewhat critical tenor of his remarks concerning the Paper. He also wished to thank Mr. Wesley Lambert for so kindly acting as chairman and supporting him, the lantern operator for his services, and the company generally for their appreciative hearing.

Inflated Copper Values.

By "Onlooker."

The rise in copper may be very satisfying to the producers of the metal to whom enormous profits are now accruing, and pleasant enough to speculators who have reaped a golden harvest from the upward flight of standard copper values in London, but among manufacturers and consumers generally there is not a good word to be said for it. Non-ferrous works throughout the country are, generally speaking, well occupied, but this activity comes from orders placed prior to and during the very early days of the present rise, for latterly buying has been on a very meagre scale. Reports from the States say that purchasing there continues on a heavy scale, but there is a growing concensus of opinion here that consumers across the Atlantic are very long of copper, and that a marked lull may be expected at any time.

Be that as it may, the fact remains that copper has been pushed up to a dangerously high level, but from which at the moment there are now apparent definite signs of a recession, and users of brass and copper sheets, strip, wire, etc., are all holding off in the hope that a set-back will occur. In this they have been to some extent encouraged by the widespread between standard and electro, and the fact that secondhands have been offering refined copper below the exporters' price. This has been reflected in the electro quotation on the London Metal Exchange, which has stood at a considerable discount below the figure at which the American combine is offering. All things considered, it is fairly obvious that London is taking a much more conservative view of copper values than America, but unfortunately London no longer controls the situation as she did.

The first result of this tremendous "boost" of copper values was stagnation. Consumers have covered well ahead, are finding fresh orders very scarce and deliberately holding off the market, hoping for a reaction to more reasonable levels and fearing such a slump in their holding. From every side come indications that manufacturers, who have hitherto bought copper and brass, are turning their attention to substitutes, while engineers are busy trying out the possibilities of iron and steel. In Germany an association, which was formed during the war years, to promote research into the possibility of replacing copper and brass has been revived, while aluminium manufacturers have instituted a rebate scheme to encourage sales of their product.

The railway companies, which have always been very big users of copper, are understood to be considering very seriously the advisability of changing over to something cheaper. Steel flue tubes have been used by some of the lines ever since the war, and now there is talk of locomotive fireboxes being made from the same material. This has, of course, been the practice in the States for years past, and there does not seem to be any reason why the plan should not succeed in Britain. Should replacement by steel develop, there will, no doubt, be a tendency towards clearing out the copper while the price is high, and the scrap market will in consequence be well provided with material.

Coming down to the smaller articles in everyday use, such as ashtrays, lamps, door furniture, electric-light fittings, etc., there is every chance that aluminium and rustless steel will make inroads on the field hitherto occupied by brass and copper. The same remarks apply to bathroom equipment, *e.g.*, taps, glass-holders, etc., which are already much in favour in white metal and Staybrite steel, which is also pushing its way to the front in numerous everyday shapes. It must be remembered that copper has practically doubled in price during the past two or three years, and the progress made in popularising the metal for many uses previously not available has been due to its cheapness. Experience shows that a period of over valuation, even though not of long duration, puts a metal out of the running for a considerable time, since the ground lost has to be regained, inch by inch. Rightly or wrongly, the Exporters' Incorporated have been blamed for inflation in copper, and, where a change over is made to steel and aluminium, a return to the old favourite will hardly be made as long as that body remains in power.

Book Review.

Practical Steelmaking. By Walter Lister. Published by Chapman & Hall, 11, Henrietta Street, Covent Garden, London, W.C.2. Price 25s. net.

We would not care one iota if there were an unlimited number of technical mistakes in this book, because the author has recorded observations of what he himself has carried out. If only others would do this, what a wealth of knowledge would become available!

We have only one objection to books of a practical character, and that is an author will, for the sake of completeness, draw on published sources of information to supplement his knowledge of processes of which he has had little or no practical experience.

The book is very chattily written, and somehow or other we feel that it would be spoilt by a close sub-editing to eliminate the capital "I." After perusing a few chapters it is quite easy to differentiate between the portions which have been compiled and those which are based on the author's wide experience. We were rather intrigued by the analyses set out on page 336. They outline typical compositions of electric furnace slags. We have had a considerable experience in this particular direction, and we would suggest that all the slags show an excessive amount (say 12 per cent.) of magnesia, which rather indicates that they are incorporating a certain amount of fettling material. Again, a calcium carbide figure is rather an elusive proposition, as most samples of white slag (at least in Britain's climate) immediately on cooling disintegrate and evolve acetylene and so automatically reduce the carbide content. If one could get accurate figures, we should never be surprised if the percentage reached seven in many cases.

The author's experience of repairing and maintaining electric furnace hearths coincides with the reviewer's. His fear of fluor spar and his appreciation of mill scale for maintaining a reasonable level are also shared. We note that the author has written his book at Reinosa, in Spain, where electric furnaces are in operation, and during our short experience of Spanish conditions we satisfied ourselves that excellent dolomite was available, but we were there during the hot weather, and the absence of moisture in the atmosphere gave ideal conditions for its preservation.

The making of conductive hearths for electric furnaces has always interested us, and we believe that we were the first metallurgist to employ a diminishing carbon content as the surface of the bath was reached. Unlike the author, we used (though we believe the idea must be credited to Mr. Etchells) buried steel spikes in places remote from the electrodes, with the object of equalising the electrical conductivity of the hearth. However, the basic principle is the same as the author's, that is, to increase the electrical conductivity in the lower regions of the hearth.

On page 111, dealing with the preparation of dolomite for use with the open-hearth furnace, we think we could usefully add the tip to use a minimum of tar, that is, just sufficient to colour the mixture black. Furthermore, if any spongy places develop during ramming, they should be excavated and replaced by much drier material.

On page 159 the author deals with boils in the "breast." His method is to transfer the boil from a newly-exposed and relatively cold spot to a still colder piece of steel. That is usually effective, but inversely, the "newly-exposed" part with which boils can be associated can be cured by warming up that area by "burning" aluminium or ferro-silicon in its proximity.

One could continue comparing notes and practical experiences almost *ad infinitum*, which is the true fascination of this book. Never have we reviewed a book which gave us more pleasure, though we admit it recalled a few worries encountered years ago which we long ago thought best to forget.

In short, the scope of this book is to cover steelmaking by most commercial methods from the technico-practical point of view, that is to say, information is rendered available for the practical operation of Bessemer, open hearth and electric furnace plants, together with a chapter on a branch of heat treatment and the manufacture of ferro-silicon.

The book contains over 400 pages, is well illustrated and badly indexed. We sincerely and heartily congratulate the author on having made an excellent contribution to practical metallurgy. He has placed at the disposal of his colleagues in the industry experience gained in a hard school—the furnace stage—a school with which the reviewer is proud to be associated as an "old student." We strongly recommend our readers who are practically engaged in the manufacture of steel to include this interesting book in their library. V. C. F.

The Ropner Shipbuilding and Repairing Company's shipyard at Stockton, one of the oldest on the Tees, has been sold to Messrs. A. E. & F. R. Pickersgill, a local firm of marine engineers. The yard has been closed for some time.

BLACKING,
PLUMBAGO,
CORE GUM,
WHITE DUST,
COAL DUST.

ESTABLISHED 1863.

JAS. DURRANS & SONS, LTD.
PHŒNIX WORKS, PENISTONE, near SHEFFIELD.

Telephone:
21 PENISTONE.
Telegrams:
"DURRANS, PENISTONE."

FOUNDRY EQUIPMENTS

LADLES,
FIRE BRICKS,
STONE FLUX,
CASTING CLEANERS,
PIPE NAILS,
SPRIGS,
WIRE BRUSHES,
BELLOWS,
CUPOLAS,
GANISTER,
LOAM AND SAND MILLS,
STUDS,
CHAPLETS,
BRUSHES,
CORE ROPES,
BUCKETS,
SPADES, Etc.

Write for Illustrated Catalogue on Blacking and Foundry Requisites.

TEAM BY-PRODUCT COKE CO., LTD.
DUNSTON-on-TYNE
"TEAM" PATENT COKE
SPECIAL FOUNDRY QUALITY

FOR PRICE AND PARTICULARS APPLY TO:—
ALEXANDER LEITH & CO.,
25, COLLINGWOOD STREET,
NEWCASTLE-ON-TYNE.

TYPICAL ANALYSIS (if necessary guaranteed).

ASH	not exceeding	8%
SULPHUR	,, ,,	0·8%
VOLATILE	,, ,,	1 %
MOISTURE	under	1·50%

GANISTER, CUPOLA BLOCKS, FIRE BRICKS,
FIRE CLAY.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

J. GRAYSON LOWOOD & CO., LTD.
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

Trade Talk.

The shipyard trade unions have decided to make an immediate application for an advance of 5s. a week in wages.

The output of steel castings of Germany in February included 12,793 tons of basic steel, 6,238 tons of acid steel and 1,436 tons of crucible and electric steel.

A receiver has been appointed to assume control of Messrs. Henry Watson & Sons, Limited, iron and brass founders and engineers, of Walker Gate, Newcastle-on-Tyne.

The Parker Foundry Company, Limited, are being wound up voluntarily. Mr. A. G. Mellors, 1, King John's Chambers, Bridlesmith Gate, Nottingham, is the liquidator.

Messrs. Campbell, Binnie & Reid, Limited, Greenfield, Hamilton, have secured the contract for rebuilding the pithead and frame work at Dechmont Colliery, recently destroyed by fire.

Messrs. Arthur Adams, Limited, agents for Bohler Bros. & Company, Limited, tool steel manufacturers, have removed from 11, Southwark Street, S.E.1, to 21, Bedford Street, Strand, London, W.C.2.

Messrs. Fleming & Ferguson, Paisley, have just launched the 2,000-ton dredger "Otakou" for the Otago Harbour Board, Dunedin. This is the largest vessel of this class ever launched on the Cart.

Messrs. James Abernethy & Company, Limited, Ferryhill Works, Aberdeen, are to make extensions and alterations to their foundry. The firm announce that during alterations Ferryhill Foundry will continue as usual.

A contract for the supply of steel tyres over a period of years has been secured by Messrs. Vickers-Armstrongs, Limited, from the Soviet Government. The first instalment of the contract represents a sum of about £78,000.

The offices of Messrs. George Jones, Limited, rolling-mill engineers and ironfounders, of Lionel Street, Birmingham, were recently damaged by fire. The fire was prevented from spreading to other parts of the premises.

The Caledon Shipbuilding and Engineering Company, Dundee, have received an order for a passenger-cargo vessel from the London and Edinburgh Shipping Company, Limited, Leith, for service between Leith and London.

The pig-iron output of Belgian in February was 302,320 (350,680) tons, the steel-ingot output 293,840 (346,820) tons, the output of steel castings 8,180 (10,190) tons, of finished steel 266,790 (313,600) tons, and of finished iron 12,270 (14,990) tons.

The firm of Shearer & Pettigrew, ironfounders and engineers, Wishaw, has been dissolved as at December 31, 1928, by mutual consent, by the retiral of Mr. George Short Brownlie. The business will be carried on by Messrs. Andrew Shearer and Andrew Shearer, jun.

Messrs. John Brown & Company, Limited, have launched from their Clydebank yard the turbine steamer "Vienna" for the L. & N.E. Railway Company's Harwich-Hook of Holland service. Two other similar vessels, the "Prague" and the "Amsterdam," are under construction at Clydebank for the same owners.

Messrs. Charles Connell & Company, Limited, Scotstoun, Glasgow, have launched the steamer "Ben Wyvis," of 5,930 tons gross, which they have built to the order of Messrs. William Thompson & Company, Limited, Leith. Quadruple expansion engines will be supplied by Messrs. David Rowan & Company, Limited, Glasgow.

The Middlesbrough Gas and Electricity Committee have accepted the lowest local tender, that of Messrs. Ashmore, Benson, Pease & Company, Limited, of Stockton, for the work of extending the gas purifying plant. The Town Clerk has been authorised to make application to the Ministry of Health for sanction to borrow £21,675.

The launch took place, at Banff, of the motor-boat "Ray of Hope" on April 9. It is of the cruiser-stern type, and built to the order of Messrs. Alex. Watt & Company, Banff, at the yard of Messrs. Stevenson & Asher, and will be utilised mostly for operating in local waters. The "Ray of Hope" is the first cruiser-stern type of vessel to be constructed at a Banff slipway.

Notices have been posted in the St. Rollox Works of the L.M.S. Railway Company at Springburn, Glasgow, that, beginning on April 20, work will be curtailed to five days per week, Saturday being an idle day. On the other hand, the departments of the Cowlairs works of the L. & N.E. Company, which have been working five days per week since last July, resumed full time on April 6.

An official statement issued by the General Electric Company, Limited, denies the rumours which had been circulating to the effect that the company were engaged in negotiations with Associated Electrical Industries, Limited. It is stated that the General Electric Company are exploring every avenue to secure friendly agreement with the American shareholders with regard to the proposed new issue of shares, but there is no plan under consideration which suggests transfer of the control of the G.E.C.

Damage estimated between £1,000 and £1,500 was caused by an outbreak of fire at the Union Tube Works of the Scottish Tube Company, Limited, Coatbridge. Owing to a leakage in the oil supply an oil-fired furnace used for heating the ends of tubes caught alight. Attempts to extinguish the fire with sand failed, and the fire brigade had to instal a line of hose 2,500 ft. in length to cope with the outbreak. Fortunately, very little inflammable material was near and the other parts of the works were undamaged.

Three steel workers were severely burned by molten metal in an accident at Calderbank Steel Works, Airdrie, a week ago. A ladle of steel was being carried on a crane, when a lug broke, causing the metal to splash over the men, who were removed to the Glasgow Royal Infirmary. A somewhat similar accident occurred in the Dalzell works of Messrs. David Colville & Sons, Limited, Motherwell, on the following day, when one of the men was badly burned about the head and eyes. He was removed in a serious condition to Glasgow Royal Infirmary.

The 66,000-volt switchgear recently ordered from the British Thomson-Houston Company, Limited, by the Central Electricity Board for the South-East England Electricity Scheme is required in connection with the inner London network of the national "grid" scheme. This switchgear is of the "indoor-outdoor" type, and each oil-immersed circuit-breaker is rated at 600 amperes, with a rupturing capacity of 1,500,000 k.v.a. at 66,000 volts. The oil circuit-breakers are of the multi-break type, each phase being self-contained in a cylindrical tank mounted on a frame structure.

In a preliminary report issued by the directors of the Bengal Iron Company, Limited, it is stated that the result of the year's working to March 31 will not be as satisfactory as that of the previous year. This is partly due to a falling-off in orders for sleepers and pipes and partly to the fact that the railway board are not now entering into long-term contracts as formerly. This leads to irregular employment of labour and to increased working costs. While orders for pipes and sleepers have been disappointing, the demand for pig-iron has been fairly good. The board anticipate that the profit-sharing arrangement with the Indian Iron and Steel Company, Limited, will show a net result approximating that of last year.

Contracts of a total value of nearly £550,000 have been placed in connection with the new electric power station which is to be established at Sheffield under the Mid-East England scheme recently adopted by the Central Electricity Board. An order for the first generating unit, amounting to £94,413, has been placed with the English Electric Company, Limited, who will manufacture the 35,000-h.p. multi-cylinder steam turbine at their Rugby works and the electric generator at Preston. The unit will have an output of 25,000 kw., will run at 3,000 r.p.m., and will be supplied complete with condensing plant. An "English Electric" shunting locomotive is also being supplied for the haulage of coal, ashes, etc. Other contracts are as follow:—Brightside Foundry and Engineering Company, Limited, pipe works and valves, £25,492; Mitchell Conveyor and Transporter Company, Limited, civil engineering works, £172,893, and coal-handling plant, £23,292; General Electric Company, Limited, switchgear, £55,067; British Electric Transformer Company, Limited, transformers, £5,008; Isles, Limited, crane, £5,421.

Personal.

Mr. Cyril Watts, who has been secretary of the South Wales Tinplate Corporation, Limited, since its formation, has been elected a director of the company. Mr. Watts will continue to act as secretary.

Wills.

Atkinson, W. E., of Haxellville Road, Hornsey Lane, N., for many years connected with Messrs. Babcock & Wilcox, Limited £14,592

Contracts Open.

Boghall, Ireland, April 22.—640 lineal yds. of 3-in. cast-iron water main, for the Wicklow County Board of Health. Mr. J. T. O'Byrne, Bridge Street, Wicklow.

Giza, Cairo, June 19.—Metal cabinets and safes, for the Survey of Egypt. The Department of Overseas Trade. (Reference B.X. 5,186.)

Johannesburg, May 11.—Cast-iron pipes, fittings, etc., for the City of Johannesburg, Stores Department. The Department of Overseas Trade. (Reference A.X. 7,729.)

Sandown, I. of W., April 24.—890 tons of cast-iron pipes of 12-in. to 3-in. dia., including special castings, for the Urban District Council. Messrs. G. H. Hill & Sons (Manchester), civil engineers, 40, Kennedy Street, Manchester. (Fee £1 1s., returnable.)

Warrington, April 22.—530 lineal yds. of cast-iron ornamental railings, for the Cemetery Committee. The Borough Surveyor, Town Hall.

Angora, April 25.—Five turntables, for the Administration Générale des Chemins de Fer et des Ports d'Etat. The Department of Overseas Trade. (Reference A.X. 7,730.)

Bournemouth, April 22.—Hot-water plant, heating, ventilation, electrical generating and other plant, for the Town Council. Mr. F. P. Dolamore, borough engineer, Town Hall, Bournemouth. (Fee £5 5s., returnable.)

Canada.—Copper-smelting and refining plant, for a local firm. The Department of Overseas Trade. (Reference A.X. 7,683.)

London, S.E., April 30.—Four 65-ton steam breakdown cranes, for the India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

Wellington, N.Z., May 7.—Two electric motor-driven centrifugal pumps, for the New Zealand Public Works Department. The Department of Overseas Trade. (Reference A.X. 7,738.)

Obituary.

Mr. A. C. Meyjes, who was for twenty-six years editor of the "Ironmonger," has died in his 71st year.

Mr. J. L. Potts, a former chairman of directors of Messrs. J. H. Andrew & Company, Limited, Toledo Steel Works, Sheffield, died recently.

Mr. H. F. Huntsman, chairman of Messrs. B. Huntsman, Limited, crucible steel manufacturers, Sheffield, and of the Tinsley Park Colliery Company, Limited, died recently, at Retford, in his 75th year.

Mr. Levi Lovett, one of the pioneers of miners' trade unionism in Leicestershire, has died at Swannington, at the age of 75. Mr. Lovett was largely instrumental in the formation of the Coalville and District Miners' Association, of which he was President. As the Association grew, it was renamed the Leicestershire Miners' Association.

The death occurred, on March 29, of Mr. W. Reid, who had just completed 50 years' service with Messrs. M'Dowell, Steven & Company, Limited, Laurieston Foundry, Falkirk. Mr. Reid had for many years been the firm's chief cashier, and steps were being taken to recognise in a suitable manner the attainment of his jubilee.

Reports and Dividends.

Brown Bayley's Steel Works, Limited.—Preference dividend of 6d. per share for the half-year ended January, 1927.

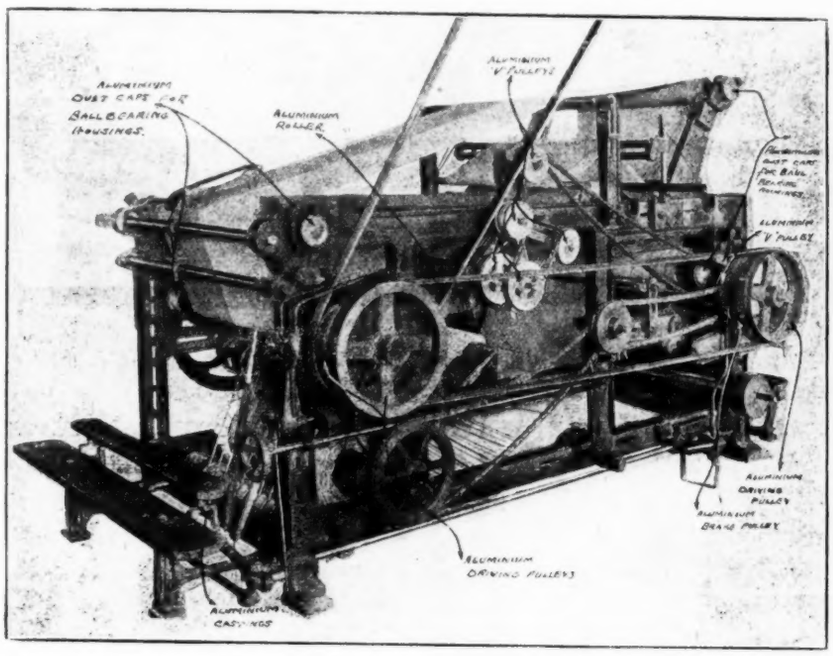
Babcock & Wilcox, Limited.—Final dividend on the ordinary shares of 8 per cent., tax free, making 15 per cent., tax free, for the year.

Cammell Laird & Company, Limited.—Loss for 1928, after charging depreciation and paying debenture interest, £80,694; transferred from reserve, £75,000; credit balance carried forward, £5,921. No dividends are proposed on the preference or ordinary shares.

Messrs. Hudswell, Clarke & Company, Limited, Leeds, have received an order from a Chilian railway company for a 300/330-h.p. Diesel locomotive, with a gauge of 2 ft. 6 in. and a 2-6-2 wheel arrangement. They have also an order from a firm of public works contractors for six electric-battery locomotives.

Lightness saves Energy.

When moving parts of textile machinery are lightened, inertia is lessened and, consequently, energy is saved in acceleration and deceleration.



This principle is illustrated here in a velvet cutting machine (by Drey, Simpson & Co., Ltd.), employing aluminium alloy castings.

Aluminium Alloys

The British Aluminium Co., Ltd., Aluminium Producers, Adelaide House, London, E.C.4.

WARNER'S CYLINDER PIG IRON

BRAND "WARNER C.B.R."

THE WORLD'S BEST

As supplied to the leading.... RAILWAY COMPANIES, LOCOMOTIVE, DIESEL and OIL ENGINE BUILDERS.
Also unequalled for AUTOMOBILE CYLINDER BLOCKS. COMPRESSORS, ENGINEERS' TOUGH CASTINGS and CHILLED ROLLS.

WARNER & CO. LTD.

CARGO FLEET, MIDDLESBROUGH ON TEES.

TELEGRAMS: REFINERY MIDDLESBROUGH.

ALSO MAKERS OF HIGH CLASS REFINED PIG IRON IN SMALL PIGS, FOR ALL KINDS OF MALLEABLE CASTINGS

TELEPHONE: MIDDLESBROUGH 4265.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—As had been confidently expected in market circles, the continuous expansion of demand for Cleveland iron at home and abroad has had a hardening effect upon prices, and it is now practically impossible to obtain No. 3 G.M.B. quality foundry pig under 68s. 6d., or 1s. 6d. advance on the minimum rate hitherto in force for some time past. This movement has perhaps retarded business in some directions, but the conditions are entirely in favour of sellers, who entertain no doubt about their ability to realise the higher prices now ruling. Moreover, makers contend that the rise does not cover the increase in the cost of production occasioned by the advance in the price of coke and ore. Since the beginning of the year blast-furnace coke alone has advanced by 2s. 6d. per ton, and, moreover, it is so scarce that the expansion in the iron trade has been seriously retarded. At the moment ironmasters have only limited supplies available for disposal for delivery earlier than June, while booking has been good for the second half of the year. Shipments abroad are also on an increased scale, and are anticipated to exceed the March returns. The following now represent current quotations:—No. 1 Cleveland foundry iron, 71s. per ton; No. 3 G.M.B., 68s. 6d. per ton; No. 4 foundry, 67s. 6d.; No. 4 forge, 67s. per ton.

Following a period of heavy buying of East-Coast hematite, it is not surprising to learn that quieter conditions now prevail, but some important contracts have been placed both for prompt and forward delivery, and prices continue firm, quotations ruling for small prompt sales being 74s. per ton for mixed numbers and 76s. for No. 1 quality. On the North-West Coast prices are unchanged at 74s. per ton for Bessemer mixed numbers, delivered works.

LANCASHIRE.—Consumers of foundry pig within this area are at present confining business to more immediate needs, but are, however, specifying for regular deliveries, and an increase in the volume of new tonnage may be expected as existing contracts get worked off. For delivery to consumers in the Lancashire zone, Staffordshire No. 3 is on offer at 73s. 6d. per ton, with Derbyshire makes at 2s. 6d. less.

THE MIDLANDS.—The quarterly meeting last week stimulated to some extent a rather more active demand for pig-iron, but there were, however, no heavy transactions involved, and, generally speaking, consumers who have not already contracted are confining their purchases to limited quantities. The minimum zone prices continue to operate, these being 72s. 6d. per ton for No. 3 Derbyshire, 69s. for No. 3 Northants, and 75s. for North Staffordshire, including delivery to Black Country and Birmingham stations.

SCOTLAND.—The market for Scottish pig-iron continues dull, the Falkirk and other light-castings founders being only moderately employed, and not interested in making new purchases to any extent, as they are in arrears in taking out iron already bought. There is no change in the basis price for No. 3 foundry, which remains at 72s. 6d. per ton f.o.t. furnaces.

Finished Iron.

Little change is perceptible in the prices of the various grades of finished iron. Figures previously quoted are firmly held, and it is quite possible that further advances will take place in view of the scarcity of scrap and the higher prices which are being asked for forge pig-iron. The demand also is maintained at a higher level, although it is still by no means sufficient to keep the works fully occupied. Marked bars remain at £12 per ton at makers' works, which are fairly well occupied in this direction. Crown iron prices vary considerably, but for a good brand £9 15s. to £10 is demanded, and in certain directions figures of round about £9 7s. 6d. to £9 12s. 6d. are quoted. Nut and bolt iron, for which there is a very poor demand at the moment owing to Continental competition, is offered at between £8 17s. 6d. and £9 2s. 6d. per ton delivered works in this district.

Scrap.

Business in most descriptions of foundry scrap material during the current week has been confined within moderate limits, but prices are generally at rather firmer levels. At Middlesbrough the cast-iron market is still very quiet, and buyers are only offering 62s. 6d. for ordinary quality and 66s. for machinery quality. In the Midlands the demand for cast-iron scrap has been well maintained, and 70s. delivered can be realised for machinery scrap in cupola sizes, with 57s. 6d. to 60s. delivered for lighter qualities. In Scotland machinery cast-iron scrap, suitable for foundries, is, if anything, a little easier, and merchants find it difficult to obtain outlets at around 73s. 6d. to 75s., while ordinary heavy cast iron is quoted at 67s. 6d. to 70s., according to quality, with cast-iron railway chairs at 70s. Light cast-iron scrap is at 67s. 6d., and cast-iron firebars 64s. The above prices are all per ton delivered f.o.t. consumers' works.

Steel.

The outlook in the steel industry is gradually clearing, and at Sheffield the market is quite firm, with an improving tendency. Basic steel billets continue to be prominent, and easily outstrip the demands for acid qualities, which have been rather dull for months past. Wire rods are a good market. Prices all round are firm and rule as follow:—Basic billets: Soft, £6 17s. 6d.; hard, £7 5s., £7 15s. and £8 15s.; Siemens acid billets, £8 15s. to £9; soft wire rods, £7 12s. 6d. to £7 15s.; hard, £10 5s. Constructional engineers in Lancashire are, for the most part, engaged at below capacity, and the expected improvement in conditions in this branch of the trade shows no indication as yet of materialising. Locomotive builders and boilermakers, also, are taking only relatively small quantities at the moment, although there is a moderate demand from general engineers. The tinplate markets shows signs of improvement, and makers are quoting firm prices, which represent an increase of about 3d. per standard box compared with a few weeks ago.

Metals.

Copper.—Subsequent to the recent sensational collapse of warrant copper values, the market has passed through a period of heavy realisation, which has resulted in almost panic conditions in the daily list of quotations. A reactionary movement, however, is imminent, and it would appear that the recent fall is in reality only the natural outcome of the former impossible circumstances. With regard to the future, the outlook at the moment is uncertain, but it must be admitted that the position is fundamentally sound and a recovery sooner or later may be regarded as almost inevitable.

Closing quotations are :—

Cash.—Thursday, £82 5s. to £82 10s.; Friday, £82 15s. to £83; Monday, £77 7s. 6d. to £77 10s.; Tuesday, £75 to £75 2s. 6d.; Wednesday, £77 15s. to £78.

Three Months.—Thursday, £79 7s. 6d. to £79 10s.; Friday, £79 7s. 6d. to £79 10s.; Monday, £73 15s. to £73 17s. 6d.; Tuesday, £72 5s. to £72 10s.; Wednesday, £75 10s. to £75 15s.

Tin.—In sympathy with the position in the copper market, values of standard tin have also experienced a drooping tendency, due, it must be admitted, partly to the unfavourable statistical returns, showing conclusively that supplies keep well up to the average consumptive demand, while stocks in hand and afloat at the moment are more than adequate to meet all normal requirements. The outlook for the future, however, is not easily judged, and, with the activities of the group veiled in mystery, the position must be regarded as uncertain.

Official closing prices :—

Cash.—Thursday, £210 10s. to £210 15s.; Friday, £208 5s. to £208 7s. 6d.; Monday, £203 5s. to £203 10s.; Tuesday, £205 2s. 6d. to £205 7s. 6d.; Wednesday, £207 5s. to £207 7s. 6d.

Three Months.—Thursday, £211 5s. to £211 10s.; Friday, £209 to £209 2s. 6d.; Monday, £204 to £204 5s.; Tuesday, £205 17s. 6d. to £206; Wednesday, £207 17s. 6d. to £208.

Spelter.—The spelter market has shown a weaker tone of late on account of liquidation resulting from a rather over-bought position and a lack of any active support. Consumptive demand has tended to slacken, and American advices report that conditions there are quieter and that consumers for the moment would appear to be covered.

Daily quotations are :—

Ordinary.—Thursday, £26 13s. 9d.; Friday, £26 13s. 9d.; Monday, £26 12s. 6d.; Tuesday, £26 10s.; Wednesday, £26 13s. 9d.

Lead.—As a result of the declines in other markets, the demand from consumers of soft foreign pig has fallen off considerably, and for the moment they show no desire to commit themselves heavily and generally lack confidence. Opinions are held, however, that consumers are not well covered, and when the position becomes more stabilised they will enter the market again.

Prices have been :—

Soft Foreign Prompt.—Thursday, £24 5s.; Friday, £24 12s. 6d.; Monday, £24 10s.; Tuesday, £24 5s.; Wednesday, £24 12s. 6d.

Institute of British Foundrymen.

LANCASHIRE BRANCH (JUNIOR SECTION).

The annual meeting of the Junior Section of the Lancashire Branch of the I.B.F. was held on April 13 at the Manchester College of Technology. Mr. T. Makemson presided.

The report of the secretaries (Messrs. Burgess and Yeoman) stated that the membership was about 100 and the attendance at the meetings averaged about 60. There had been two works visits; 40 members went to Messrs. Tweedale & Smalley, Limited, and 60 members went to the works of Leyland Motors. A wide field was covered by the Papers which had been read. Mr. J. E. Garside won the "John Wilkinson" medal; in a competition for which members of the Junior Section wrote short Papers a prize was offered by Mr. Jolley, but the winner could not yet be announced, as the examiners had not completed their work.

A vote of thanks to the retiring officers was carried unanimously, on the proposition of Mr. J. S. G. Primrose.

Mr. R. A. Miles was elected President, in succession to Mr. Makemson. In moving the resolution, Mr. Makemson pointed out the qualifications of Mr. Miles for the post; he had a long and distinguished membership, having been President of the Lancashire Branch.

Other appointments were:—Vice-President, Mr. A. L. Key; Council: Messrs. Garside, Pattison, Sutcliffe, Potts, Nicholls and Thompson; joint hon. secretaries, Messrs. A. Burgess and R. Yeoman.

Mr. A. Phillips, of Manchester, read a Paper on "Die Casting." It was illustrated by lantern slides. After a discussion a vote of thanks was accorded to Mr. Phillips, on the motion of Mr. Yeoman, seconded by Mr. Nicholls.

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

11,128. Kluijtmans, C. E., and Proctor, W. H. W. Manufacture of malleable cast iron. 288,980.

2,134. Nicholls, W. H. Foundry moulding machine. 305,358.

3,737. Harrington, W. A. Centrifugal apparatus for moulding metal. 305,367.

29,375. Sedgwick, C. H. Machinery for bending metal sheets or plates. 305,262.

25,769. International Nickel Company. Chill cast-iron alloys. 279,414.

20,438. Galassini, E. Casting hollow metal containers. 275,621.

24,837. Jambon, M. C. E. Blast apparatus for furnaces. 291,367.

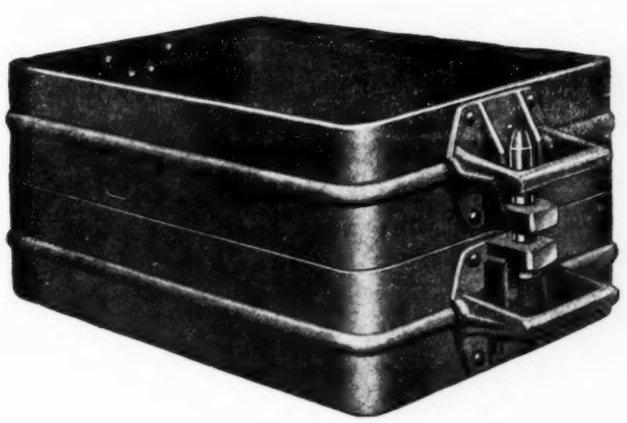
28,422. Farrar, F. R., and Ellison, A. D. Formation of sand moulds for metal castings. 306,195.

10,962. Miller, H. L. Corrosion-resistant ferrous alloys. 306,320.

HIGHER PRODUCTION
AT LESS COST
AND MORE ACCURATE CASTINGS
WITH
Sterling
BOXES

LESS FETTLING
FEWER WASTERS
CLEANER CASTINGS

YOUR FOUNDRY
IS WORKING
AT A DISADVANTAGE
WITHOUT THEM.



WRITE FOR CATALOGUE No. 37
AND LOOK INTO THE
MATTER AT ONCE.

STERLING FOUNDRY SPECIALTIES LTD.
BEDFORD

London Office :
13, VICTORIA STREET, S.W.1.

Telephone : 3345 BEDFORD.
Telegrams : "STERFLASK, BEDFORD."
Code : WESTERN UNION.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	77	15	0
Three months	75	10	0
Electrolytic	84	0	0
Tough	78	10	0
Best selected	79	0	0
Sheets	119	0	0
India	100	0	0
Wire bars	84	0	0
Do. May	84	0	0
Do. June	84	0	0
Ingot bars	84	0	0
H.C. wire rods	88	0	0
Off. av. cash, March	89	4	4½
Do. 3 mths., March	90	11	0
Do., Sttlmnt., March	89	3	6
Do., Electro, March	98	16	10½
Do., B.S., March	95	9	2
Aver. spot price, copper, Mar.	89	4	4½
Do. wire bars, March	99	6	7½
Solid drawn tubes			16d.
Brazed tubes			16d.
Wire			13d.

BRASS.

Solid drawn tubes	13½d.
Brazed tubes	15½d.
Rods, drawn	13½d.
Rods, extd. or rlld.	8½d.
Sheets to 10 w.g.	11⅞d.
Wire	11⅜d.
Rolled metal	11⅜d.
Yellow metal rods	9d.
Do. 4 × 4 Squares	10d.
Do. 4 × 3 Sheets	10½d.

TIN.

	£	s.	d.
Standard cash	207	5	0
Three months	207	17	6
English	207	5	0
Bars	207	5	0
Straits	206	12	6
Australian	206	2	6
Eastern	207	15	0
Banca	209	2	6
Off. av. cash, March	220	17	4½
Do., 3 mths., March	221	15	5½
Do., Sttlmt., March	220	17	6
Aver. spot, March	220	17	4½

SPELTER.

	£	s.	d.
Ordinary	26	13	9
Remelted	26	0	0
Hard	21	5	0
Electro 99.9	29	15	0
English	26	17	6
India	22	10	0
Zinc dust	(Nom.) 36	10	0
Zinc ashes	9	0	0
Off. aver., March	27	3	5½
Aver., spot, March	27	1	0

LEAD.

	£	s.	d.
Soft foreign ppt.	24	12	6
English	26	0	0
Off. average, March	25	9	11½
Average spot, March	25	8	2½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	34	5	0
Do. V.M. ex whf.	33	7	6
Rods	42	0	0
Boiler plates	31	0	0
Battery plates	32	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	54	10	0
Chinese	37	15	0
Crude	33	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	3	9

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	17	6
45/50%	12	0	0
75%	19	10	0
Ferro-vanadium—			
35/50%	..13/9 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	..3/8 lb. Mo.		
Ferro-titanium—			
23/25% carbonless	11d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%, c. fr.	2/10½ lb.		
Tungsten metal powder—			
98/99%	3/2½ lb.		
Ferro-chrome—			
2/4% car.	£35	0	0
4/6% car.	£25	0	0
6/8% car.	£24	0	0
8/10% car.	£23	12	6
Ferro-chrome—			
Max. 2% car.	£35	0	0
Max. 1% car.	£38	0	0
Max. 0·70% car.	£42	0	0
70%, carbonless	1/2 lb.		
Nickel—99%, cubes or pellets	£175	0	0
Ferro-cobalt	9/4 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/6 lb.		
Ferro-manganese (net)—			
76/80% loose	£13	15	0
76/80% packed	£14	15	0
76/80%, export	£14	10	0
Metallic manganese—			
94/96%, carbonless	1/6 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0	2	0
Finished bars, 18% tungsten	£0	2	9

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{3}{16}$ in.	1/– lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/– lb.
Bevels of approved sizes and sections	6d. lb.
Bars cut to length, 10% extra	

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	3	19	0	to	4	0	0
Bundled steel and shrngs	3	15	0	to	3	19	6
Mixed iron and steel	3	12	6	to	3	15	0
Heavy cast iron	3	5	0	to	3	7	6
Good machinery for foundries	3	7	6	to	3	10	0
Cleveland—							
Heavy steel					3	3	6
Steel turnings					2	15	6
Cast iron borings					2	10	0
Heavy forge					3	15	0
W.I. piling scrap					3	10	0
Cast-iron scrap	3	2	6	to	3	6	0
Lancashire—							
Cast-iron scrap	2	17	6	to	3	10	0
Hvy. wrought					3	15	0
Steel turnings					2	15	0
Scotland—							
Heavy steel					3	15	0
Cast-iron borings					2	15	0
Wrought-iron piling					3	12	6
Heavy machinery					3	13	6

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	68	0	0
Brass	45	0	0
Lead (less usual draft)	21	0	0
Tea lead	17	0	0
Zinc	18	0	0
New aluminium cuttings	67	0	0
Braziery copper	63	0	0
Gunmetal	58	0	0
Hollow pewter	170	0	0
Shaped black pewter	115	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	71/–
Foundry No. 3	68/6
Foundry No. 4	67/6
Forge No. 4	67/–
Hematite No. 1	74/6
Hematite M/Nos.	74/–
N.W. Coast—	
Hem. M/Nos. d/d Glas.	83/6
,, d/d Birm.	90/6
Midlands—	
Staffs. common*	—
,, No. 4 forge*	71/–
,, No. 3 fdry*	75/–
Shrops. basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	65/–
,, fdry. No. 3*	69/–
Derbyshire forge*	68/6
,, fdry. No. 3*	72/6
,, basic*	—
* d/d Black Country dist.	
Scotland—	
Foundry No. 1	75/–
,, No. 3	72/6
Hem. M/Nos.	77/–
Sheffield (d/d district)—	
Derby forge	63/6
,, fdry. No. 3	67/6
Lincs. forge	67/6
,, fdry. No. 3	71/6
E.C. hematite	85/–
W.C. hematite	87/–
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	71/–
Northants foundry No. 3	—
Dalzell, No. 3 (special)	100/– to 102/6
Summerlee, No. 3	90/–
Glengarnock, No. 3	—
Gartsherrie, No. 3	90/–
Monkland, No. 3	90/–
Shotts, No. 3	90/–

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.) nom.					10	15	0
Nut and bolt iron	8	17	6	to	9	2	6
Hoops					11	10	0
Marked bars (Staffs.) f.o.t.					12	0	0
Gas strip					11	10	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	7	6	to	8	12	6
Boiler plts.					10	10	0
Chequer plts.					10	12	6
Angles					7	17	6
Tees					8	17	6
Joists					7	17	6
Rounds and squares, 3 in. to 5½ in.					8	17	6
Rounds under 3 in. to ⅜ in. (Untested)					7	15	0
					and upwards		
Flats, over 5 in. wide and up					8	7	6
Flats, 5 in. to 1¼ in.					7	17	6
Rails, heavy					8	10	0
Fishplates					12	10	0
Hoops (Staffs.)					11	0	0
Black sheets, 24g.	10	0	0	to	10	10	0
Galv.cor.shts.,24g.	13	7	6	to	13	15	0
Galv. fencing wire 8g. plain					12	10	0
Billets, soft	6	7	6	to	7	0	0
Billets hard	7	5	0	to	8	2	6
Sheet bars	6	5	0	to	6	6	6
Tin bars	6	5	0	to	6	6	6

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/5
Sheet to 10 w.g.	1/6
Wire	1/7½
Rods	1/6
Tubes	1/10
Castings	1/5

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	1/– to 1/6
Rolled—	
To 9 in. wide	1/6 to 2/–
To 12 in. wide	1/6½ to 2/0½
To 15 in. wide	1/6½ to 2/0½
To 18 in. wide	1/7 to 2/1
To 21 in. wide	1/7½ to 2/1½
To 25 in. wide	1/8 to 2/2
Ingots for spoons and forks	1/– to 1/8½
Ingots rolled to spoon size	1/3 to 1/11½
Wire round—	
3/0 to 10 G.	1/9½ to 2/4½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	18.00
No. 2 foundry, Birm.	15.50
Basic	19.26
Bessemer	20.79
Malleable	20.01
Grey forge	19.26
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y at mill	43.00
Bess billets	34.00
O.-h. billets	34.00
O.-h. sheet bars	35.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.95
Tank plates	1.95
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.20
Sheets, black, No. 24	2.85
Sheets, galv., No. 24	3.60
Sheets, blue an'l'd, 9 and 10	2.10
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.30
Tinplates, 100 lb. box	$5.35

COKE (at ovens).

Welsh foundry	25/– to 30/–
,, furnace	21/– to 25/–
Durham and North.	
,, foundry	18/– to 19/–
,, furnace	19/– to 19/6
Midlands, foundry	—
,, furnace	17/– to 17/6

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14 box	18/3
,,	28×20 ,,	36/6
,,	20×10 ,,	26/3
,,	18¾×14 ,,	18/9
C.W.	20×14 ,,	15/–
,,	28×20 ,,	33/6
,,	20×10 ,,	21/3
,,	18¾×14 ,,	15/–
Terneplates	28×20	33/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods, dead soft, steel	£10	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes.	*Fittings.*
Gas	67½%	50%
Water	63¼%	45%
Steam	60%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
April 11	82	5	0	inc.	90/-
„ 12	82	15	0	„	10/-
„ 15	77	7	6	dec.	107/6
„ 16	75	0	0	„	47/6
„ 17	77	15	0	inc.	55/-

Electrolytic Copper.

	£	s.	d.		
April 11	85	0	0	No change	
„ 12	88	0	0	inc.	60/-
„ 15	85	0	0	dec.	60/-
„ 16	80	0	0	„	100/-
„ 17	84	0	0	inc.	80/-

Standard Tin (cash).

	£	s.	d.		
April 11	210	10	0	inc.	42/6
„ 12	208	5	0	dec.	45/-
„ 15	203	5	0	„	100/-
„ 16	205	2	6	inc.	37/6
„ 17	207	5	0	„	42/6

Tin (English ingots).

	£	s.	d.		
April 11	210	15	0	inc.	40/-
„ 12	208	5	0	dec.	50/-
„ 15	203	10	0	„	95/-
„ 16	205	5	0	inc.	35/-
„ 17	207	5	0	„	40/-

Zinc Sheets (English).

	£	s.	d.		
April 11	34	10	0	dec.	5/-
„ 12	34	10	0	No change	
„ 15	34	10	0	„	„
„ 16	34	5	0	dec.	5/-
„ 17	34	5	0	No change	

Spelter (ordinary).

	£	s.	d.		
April 11	26	13	9	inc.	1/3
„ 12	26	13	9	No change	
„ 15	26	12	6	dec.	1/3
„ 16	26	10	0	„	2/6
„ 17	26	13	9	inc.	3/9

Lead (English).

	£	s.	d.		
April 11	25	15	0	inc.	5/-
„ 12	26	0	0	„	5/-
„ 15	26	0	0	No change	
„ 16	25	15	0	dec.	5/-
„ 17	26	0	0	inc.	5/-

Exports of Iron Castings in March and the three months 1929, compared with March and the three months 1928.

	March, 1928.	March, 1929.	Three months, 1928.	Three months, 1929.	March, 1928.	March, 1929.	Three months, 1928.	Three months, 1929.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
BUILDERS' CASTINGS—								
Stoves, Grates, etc., Cisterns, Baths, etc., and cooking and washing boilers—								
To Argentine Republic	127	194	435	603	4,024	8,471	17,070	29,675
„ British South Africa	263	348	1,048	956	9,424	11,876	35,912	33,551
„ „ India	132	159	483	505	5,726	5,730	21,889	18,702
„ Australia	75	24	213	224	6,082	1,784	14,636	12,713
„ New Zealand	165	146	576	409	7,327	6,303	27,667	33,849
„ Other countries	767	892	2,342	2,699	34,453	38,913	107,344	118,806
Total	1,529	1,763	5,097	5,396	67,036	73,077	224,518	247,296
PIPES AND FITTINGS—CAST—								
To Argentine Republic	1,064	6,760	2,191	11,404	9,969	61,216	22,693	110,790
„ British South Africa	596	290	1,280	1,319	8,375	5,058	18,682	19,813
„ „ India	1,736	232	2,791	1,140	16,239	3,287	32,516	17,953
„ Straits Settlements and Malay States	646	1,684	3,873	7,240	7,423	11,715	35,491	52,030
„ Ceylon	49	37	246	231	719	513	3,405	2,521
„ Australia	927	557	1,807	1,500	9,705	5,672	20,269	15,195
„ Other countries	4,531	4,054	15,583	13,264	63,365	47,735	213,434	152,790
Total	9,549	13,614	27,771	36,098	115,795	135,196	346,490	371,092
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	450	375	1,158	1,164	16,516	12,804	42,821	41,432
„ Enamelled	61	77	209	208	5,698	6,533	18,511	17,913
CASTINGS, in the rough—								
Iron	98	60	312	205	3,556	3,527	11,636	9,788
Steel	26	85	121	201	1,287	4,668	5,653	10,280

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
19, ST. VINCENT PLACE, GLASGOW.
ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

SITUATIONS VACANT AND WANTED.

FOUNDRY MANAGER desires position; 25 years' practical and technical training all classes engineering and jobbing work, in grey iron, semi-steel, iron alloys, and non-ferrous metals, mix by analysis, expert on cupola, get maximum production, guarantee results, take entire charge of foundry and pattern shop.—Box 186, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

CHEMIST (Junior) required by large Motor Engineering firm, having experience in ferrous and non-ferrous metals; knowledge of metallurgy and heat treatment an advantage.—Address, stating age, experience and salary required, Box 202, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

YOUNG ENGINEER, 25/35, wanted as Assistant Foundry Manager for leading aluminium foundry in Midlands. Applications invited from men with up-to-date experience repetition castings in any metal. Personality of equal importance to specialised experience. State age, experience, salary required.—Box 200, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PATENTS AND TRADE MARKS.

PROTECT YOUR IDEAS.—Free, Advice and Handbook on patenting inventions and registering trade marks by Registered Agent with 43 years' experience.—King's Patent Agency, Limited, 146a, Queen Victoria Street, E.C.4.

THE Proprietor of British Patent No. 249636, dated February 9, 1925, relating to "Annealing Furnaces," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. Singer, Steger Building, Chicago, Illinois.

THE Proprietor of British Patent No. 147931, dated July 9, 1920 (under International Convention, April 8, 1916), relating to Improvements in Sheet and Tin Mill Furnace, is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to Mr. B. Singer, Woolworth Building, New York City, N.Y., U.S.A.

THE Proprietor of British Patent No. 227338, dated April 30, 1924, relating to "Improved process and apparatus for disintegrating and mixing moulding sand," is desirous of entering into arrangements by way of a licence or otherwise on reasonable terms for the purpose of exploiting the above patent and ensuring its practical working in Great Britain.—All inquiries to be addressed to B. Singer, Steger Building, Chicago, Illinois.

PROPERTY

11 ACRES WORKS SITE.
SHEFFIELD.
145,000 Sq. Ft. of SHOPPING,
Compact and Convenient.
SIDING CONNECTIONS
with L.M. & S. and L. & N.E. Rlys.
WELL-BUILT & COMMODIOUS OFFICES
Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—
THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

A TRAFFORD PARK BARGAIN.—Modern Foundry with own railway sidings, excellent warehouse, packing room and fine offices, centrally heated, for SALE. Premises are all one storey and easily adaptable for other trades. Cost £20,000 in 1921. For a quick sale, owners will take £2,000.—F. S. Airey, Entwistle & Company, 10, Norfolk Street, Manchester.

MACHINERY.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. Brealey & Company, Limited, Prospect Works, Hawksley Avenue, Sheffield.

LOEWE 10-in. x 10-ft. Plain Cylindrical Grinding Machine, table 12 ft. 5 in. long.

7-in. swing CHURCHILL Internal Grinding Machine.

10-in. x 20-in. LANDIS Plain Centre Grinding Machine.

B.S.A. Centreless Grinding Machines, for work about 1¼ in. dia. x 6 in. long.

Three LANCASHIRE BOILERS, 30 ft. 0 in. x 8 ft. 0 in., re-insure 150 lbs. pressure.

Two BABCOCK & WILCOX WATER-TUBE BOILERS of the W.I.F. type, with steam drum about 16 ft. 6 in. long overall x 3 ft. dia., heating surface about 940 sq. ft., re-insurable at a working steam pressure of 160 lbs. per sq. in.

NEW ~~open-top~~ self-colour Cisterns, each about 4 ft. x 4 ft. x 4 ft. deep x 14-gauge thick, with welded seams, capacity about 400 galls. each.

THIRTY (30) HORIZONTAL DOUBLE-GEARED STEAM WINCHES (Clarke Chapman), cyls. 4½ in. x 6 in.; drum 22 in. dia. x 20 in. wide; brake.

FOURTEEN (14) HORIZONTAL SINGLE-GEARED STEAM WINCHES (Lidgerwood); cyls. 8½ in. x 8 in.; drum 16 in. dia. x 19 in. wide; brake.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

STOP! LOOK! LISTEN!
FOUNDRY OWNERS.
WRITE, WIRE, TELEPHONE, CALL

FOR our 4th Edition Handbook for Foundrymen—The Success of 1929. Foundry Managers, Foremen, Superintendents, Production Managers, Core-makers, Metallurgists, Chemists, Engineers, Iron and Steel Workers, Patternmakers, Melters, Cupola Attendants, Furnace Managers (all classes of Steel-Making), should be in possession of this Handbook (no charge).

WRITE, WIRE, TELEPHONE, CALL.
Head Office and Works,
BEECROFT & PARTNERS, LIMITED,
Foundry Chemists,
Core Compounds, Plumbagoes, Foundry Fluxes, Parting Powders, etc., etc.
Retort Works, Mappin Street, Sheffield.
Laboratories, including Analytical, Physical Testing and Microscopical, St. Peter's Close, Sheffield.

RYLAND'S DIRECTORY

The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades.

HAVE YOU A COPY OF THE LATEST (1928) EDITION?

PRICE:
42/- bound in cloth.
52/- ,, morocco.

INDUSTRIAL NEWSPAPERS, Ltd.
49, Wellington St., Strand, London, W.C.2.

'Phone: 287 SLOUGH

CRANE LADLES

15 Ton STEVENSON (as New)	£65
10 Ton EVANS (as New)	£48
8 Ton EVANS (as New)	£42
5 Ton EVANS (as New)	£35
4 Ton EVANS (as New)	£30
2 Ton JACKMAN (as New)	£24
1 Ton New (enclosed gear)	£19

ANY LADLE SENT ON APPROVAL

LARGEST STOCK OF FOUNDRY PLANT IN ENGLAND. PLEASE SEND FOR LISTS

BUY FROM ME AND SAVE MONEY

Alex. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

"PEASE & PARTNERS LTD"
DARLINGTON :: :: ::

Telephone:
2630
DARLINGTON.

Telegrams:
"PEASE,
DARLINGTON."

Low Ash. Low Sulphur. Low Phosphorus.
Large Coke or Small Coke.
Dense Coke.

DURHAM FOUNDRY COKES.